ALUMINUM PAINT MANUAL

ALUMINUM COMPANY OF AMERICA

PITTSBURGH
PENNSYLVANIA

Painting a brick-lined steel stack with aluminum paint. *See page 59.*

ALUMINUM

PAINT

MANUAL

ALBRON

ALUMINUM COMPANY of AMERICA
Pittsburgh, Pennsylvania

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PREFACE

ALUMINUM PAINT, like other paints, consists essentially of a finely divided pigment dispersed in a suitable liquid or "vehicle." It may be applied by the same methods and in much the same manner as other paints; only minor modifications of technique are required to secure adequate and satisfactory results. Aluminum paint may be brushed, sprayed, or dipped. It can also be applied by flow coating or roller coating. Its working properties may be adjusted to conform to all the accepted standards of flow, set, drying, and leveling that may be required of any kind of paint. Consequently, no fundamental difficulties interfere with its successful and general use as a protective and decorative coating.

This manual serves as a guide for the selection of the proper aluminum paint for any particular service and offers directions for the most efficient methods of mixing and applying it. These recommendations are based on many years of experience in the practical use of aluminum paint and have been confirmed by the extensive investigations of the Aluminum Research Laboratories of Aluminum Company of America.

Readers interested in further and more detailed technical information on aluminum paint and pigments can obtain it from the book "Aluminum Paint and Powder," by Junius D. Edwards, (Reinhold Publishing Corporation, 330 West Forty-second Street, New York City).

CHARACTERISTICS OF ALUMINUM PAINT

While aluminum paint is similar to other paints in working properties it is fundamentally different in the structure of its film. The aluminum pigment particles, instead of being granular in shape, are in the form of minute flakes. In the paint film these flakes do not occupy the entire space, but are arranged in more or less parallel layers, from 5 to 10 particles deep, with a thin cement of vehicle between each layer. (See Figure 1.) The top layer of flakes forms an apparently continuous film of aluminum. This phenomenon is known as "leafing" because the flakes in the film are arranged much like fallen leaves. It is to this leafing action that aluminum paint owes many of its properties. Without leafing it would be only a gray-appearing film of limited application.

DURABILITY

Aluminum paint is durable because the metal flakes are opaque to light and impervious to moisture. All drying oils are adversely affected by sunlight, particularly the ultraviolet rays of sunlight.

Figure 1—*Cross-section of two-coat aluminum paint film. White area is the metal surface on which the paint was applied.*

Continuous exposure to sunlight soon injures a varnish film unless it is protected by suitable pigments. The laminated structure of aluminum paint films assures protection to the binder and it is only by the slow weathering away of each succeeding layer that the time finally comes when the paint must be renewed.

MOISTURE RESISTANCE

Aluminum paint films, because of their unique structure, also protect surfaces against moisture penetration. The arrangement of the flakes in the film forces moisture to follow a much longer path around and between the innumerable flakes if it is to reach the underlying surface. This is equivalent to multiplying the film thickness several times, as will be seen by again referring to Figure 1. When it is remembered that the vehicles are in themselves varnishes with high resistance to moisture passage, it becomes evident why aluminum paint is superior to many other types of coating in this respect.

REFLECTIVITY

The reflecting characteristics of aluminum paint are excellent; it reflects between 60 and 75 per cent of light and radiant heat falling on the surface. This property is of value in most applications of aluminum paint. For example, it helps insulate structures, keeping the interior at a lower temperature, it increases the visibility of bridges, towers, and water tanks, it improves lighting efficiency on dark interiors, and, by reflecting instead of absorbing radiant energy, it protects the varnish film and gives longer life to the paint.

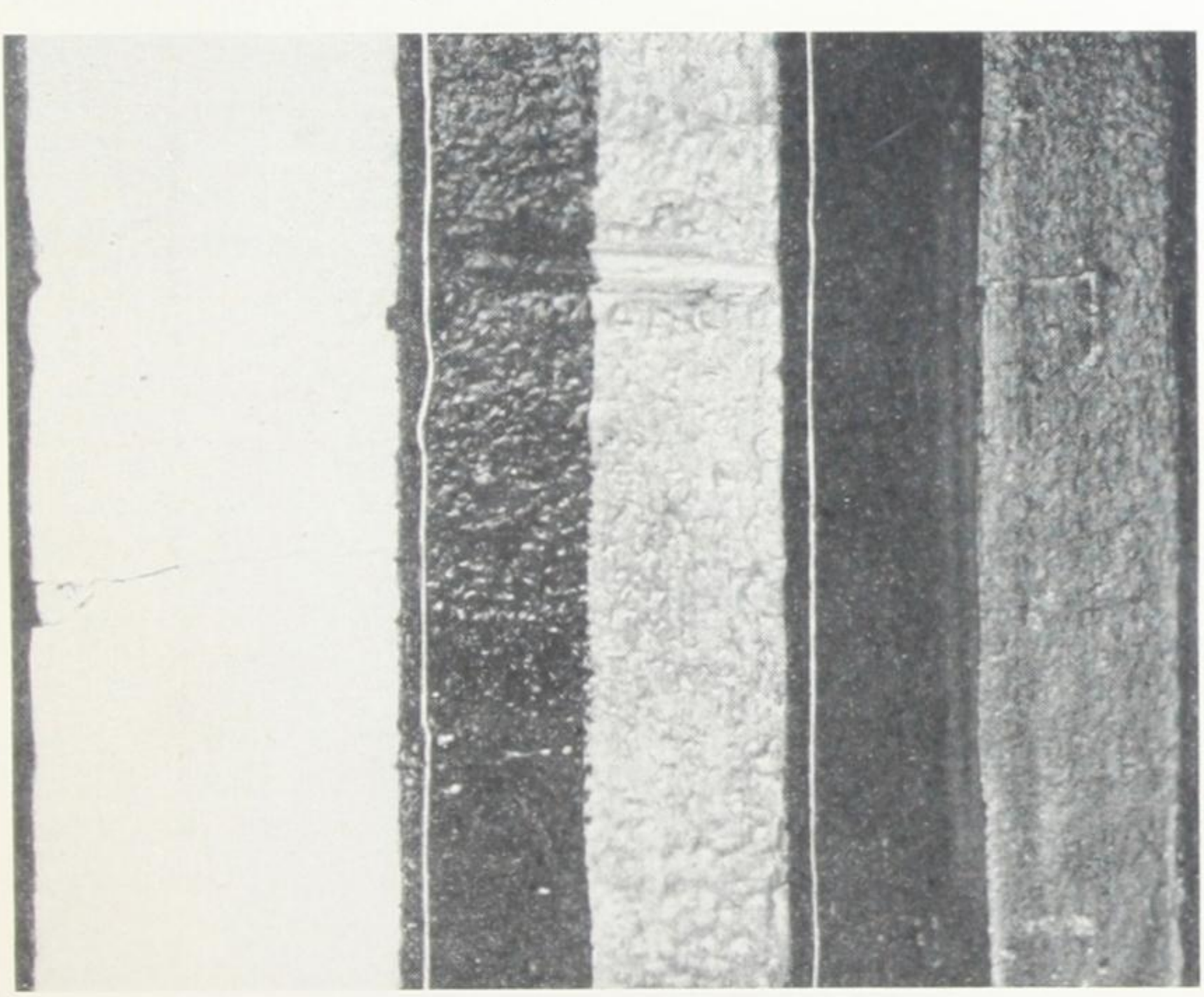
HIDING POWER

The superior hiding power of aluminum paint is another of its advantages. An aluminum paint film only .0005 of an inch thick, uniformly applied, will cover and hide any colored surface. Since the average thickness of the film is approximately twice this value, the paint easily develops its maximum reflectivity in a single coat, regardless of the color of the surface to which it is applied. This is an economy factor when painting industrial interiors that have become badly soiled and darkened by smoke and dust.

BLEEDING OF STAINS

The leafed surface of aluminum paint films makes possible the use of dark-colored vehicles such as bituminous varnishes. The

sealing action of the aluminum flakes makes aluminum paint useful over oil soluble stains, creosote, tar, asphalt, and decorative wood stains. The discoloring material dissolves in the varnish vehicle, causing it to darken, but since the surface of the powder in the leafed top layer is not wet by the vehicle, it continues to remain unaffected and bright. If the aluminum pigment has been mixed with an exceptionally good leafing vehicle, light-colored oil paints can be applied over the aluminum paint without further bleeding taking place. With very soluble stains, additional coats of aluminum may be required.



Paints for Asphalt-Coated Corkboard.

PANEL NO. 1—*Entire surface primed with aluminum paint (varnish vehicle) with 1 topcoat white paint on right half.*

PANEL NO. 2—*Entire surface primed with red lead paint with 1 topcoat white paint on right half.*

PANEL NO. 3—*Entire surface primed with zinc dust-zinc oxide paint with 1 topcoat white paint on right half.*

WEIGHT

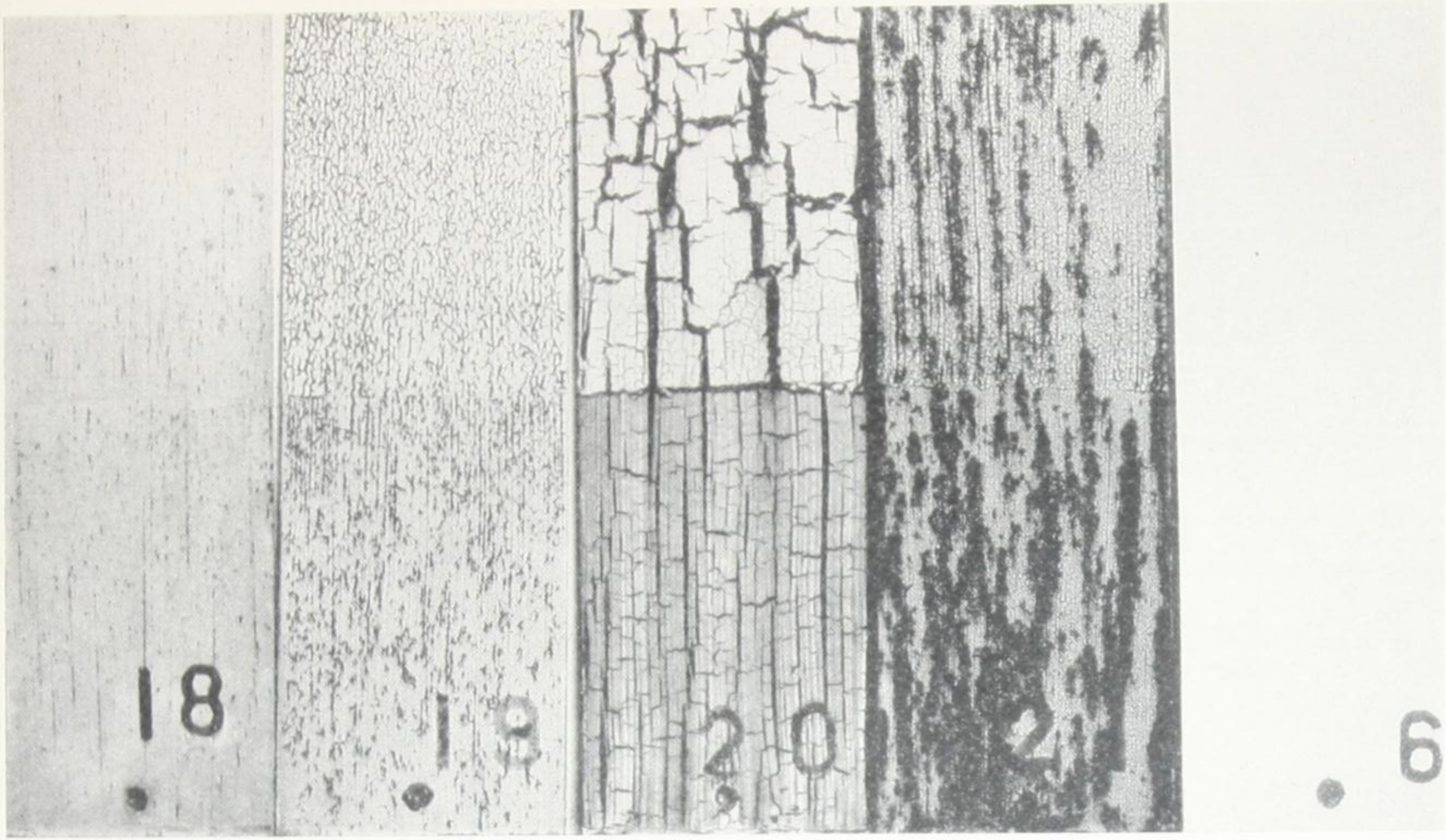
A gallon of aluminum paint weighs about the same as water, a little over 8 pounds. This is less than half the weight of many other common paints and contributes somewhat to ease of brush application. The dried film weight is approximately 5.5 pounds per gallon. This factor is of some importance where saving in weight is desirable,—such as on aircraft, battleships, and large bridges.

MIXING

Aluminum paint is usually prepared by mixing on the job, as are some types of oil paint. The advantage of this method of preparation is that the user can be certain that the paint is made up in the correct proportion of vehicle and pigment and that it is fresh. In most vehicles, aluminum powder darkens on long standing and loses some of its surface leafing. There are a number of ready-mixed aluminum paints on the market that will produce satisfactory finishes even after being mixed for six or eight months, but they are not always readily obtainable. If there is any doubt as to the quality of the ready-mixed aluminum paints available, it is much more desirable to purchase the pigment and vehicle separately or in double compartment cans and mix as required. As a means of checking the quality of a ready-mixed paint, a specification covering such a product is given on page 94.

COVERAGE

The coverage in square feet per gallon of aluminum paint depends on a number of factors. The smoothness of the surface, the amount of absorption, the consistency of the paint, the temperature, and the method of application all affect the number of gallons necessary to complete the work. An aluminum paint made with a varnish vehicle having a Tube C viscosity and mixed in the proportion of two pounds of Standard Paste per gallon can be spread on an absolutely smooth, nonabsorptive surface to cover 850 square feet per gallon if brushed, or 800 square feet per gallon if sprayed. Such high coverage is not desirable from a protective standpoint because it leaves too thin a paint film, and painters should endeavor to maintain the rate below 600 square feet per gallon to secure good durability.



Durability of aluminum paint in comparison with other light-colored paints as topcoats; No. 18, gray titanox; No. 19, white lead-zinc oxide-inert; No. 20, white lead; No. 21, lithopone-zinc oxide-inert; No. 6, aluminum paint. Photograph made after 18 months' exposure at Houston, Texas.

TABLE I

Grade	No.	Mesh Designation	Specific Gravity	Bulking Value Lb./Gal.	Approximate Covering Area on Water Sq.Cm./Gr.	Standard Proportion in Varnish per Gallon	Standard Proportion in Lacquer per Gallon	Remarks
Standard Paste	203	325	1.47	.0820	13,000	2.00 lb.	1.25 lb.	For general-purpose use. Produces smooth brilliant finish.
Extra Fine Lining Paste	1570	400	1.49	.0806	26,000	1.25 lb.		For sprayed production finishes of greatest smoothness and color.
Extra Fine Lining Paste	1571	400	1.52	.0790	26,000	1.25 lb.	.75 lb.	For inks and sprayed finishes using lacquer or special resin vehicles.
Extra Fine Lining Ink Paste	1572	400	1.77	.0678	26,000			For tinting polychromatic automobile finishes. Quantity of pigment varies depending on effect desired.
Extra Brilliant Varnish Powder	301	120	2.55	.0470	3,200	2.25 lb.	1.25 lb.	For painting industrial interiors and for ready-mixed aluminum paints.
Standard Varnish Powder	321	140	2.55	.0470	4,500	2.00 lb.	1.00 lb.	For general-purpose use. Gives a smoother more durable finish than Extra Brilliant Powder.

TABLE I—Continued

Grade	No.	Mesh Designation	Specific Gravity	Bulking Value Lb./Gal.	Approximate Covering Area on Water Sq.Cm./Gr.	Standard Proportion in Varnish per Gallon	Standard Proportion in Lacquer per Gallon	Remarks
Extra Fine Varnish Powder	341	160	2.55	.0470	5,500	1.75 lb.	.9 lb. or 14.5 oz.	For lower priced production finishes and in ready-mixed aluminum paints. Smoother finish than Standard Varnish.
Standard Lining Powder	408	325	2.50	.0480	11,000	1.25 lb.	.75 lb. or 12 oz.	For production finishes and general-purpose use where a smooth finish is necessary.
Extra Fine Lining Powder	422	400	2.50	.0480	23,000	.75 lb. or 12 oz.	.30 lb. or 5 oz.	For printing inks, lithographing, and for production finishes of maximum smoothness and luster.

Notes: 1. Mesh Designation is based upon the approximate size of the largest particles. Each grade will show some residue on standardized test screens of the same mesh size as the Mesh Designation.
2. Specific Gravity values represent average for the grade.
3. Bulking values are based on the specific gravity.
4. Covering Area on Water values are determined by dusting the dried pigment on water in a rectangular pan in such a manner as to produce a layer one particle deep floating on the water surface, and compressing the film till all particles are touching. Measurement of this area in square centimeters per gram of powder used indicates the average thickness of the flakes for each grade and the relative pigment value and quantity to use per gallon.

PIGMENTS FOR ALUMINUM PAINT

THE PIGMENT for making aluminum paint is available in two different forms,—as a paste and as a dry powder. The paste is manufactured in four different grades and the powder in five; each type and grade has certain properties which should be considered in any selection. Table I on pages 14 and 15 gives an outline of the principal characteristics of these aluminum pigments with recommendations as to where each may be best employed.

A finishes chart on page 105 shows the finishes obtainable with the different grades.

Aluminum Paste—Alcoa Albron Aluminum Paste comprises finely divided aluminum metal in flake form uniformly dispersed in a volatile paint thinner. It is produced by a new and revolutionary manufacturing process quite different from that used in making the dry powder. The paste process is fully protected by patents.*

Aluminum paste offers a major improvement in aluminum pigments. The aluminum flakes are not only much smaller than can be conveniently produced by other processes, but also the thickness of the individual flakes is less than one-half that of most of the commonly used dry powder grades. This results in a substantial increase in pigment value and makes possible more durable aluminum paints with a reduced metal content. The paste contains only 65 to 70 per cent metal, but it may be substituted pound for pound of dry powder in practically all aluminum paint formulations. The lower pigment weight improves the working qualities of the paint, and the extreme fineness of the flakes with their high polish produces aluminum paint films of unusual smoothness and brilliance at no increase in cost.

Aluminum paint made with paste pigment has superior hiding power and opacity, principally because of the much larger number of flakes per unit weight. This advantage is appreciated when attempting to hide dark or colored surfaces with one coat of paint. Because of this quality, greater coverage in square feet

*U. S. Patents No. 1,569,484, No. 2,002,891, etc.

per gallon may be obtained without detracting from the appearance of the finished work.

Aluminum paste may be used in practically any case where aluminum powder is now employed. Its many advantages (not the least of which is convenience in mixing and handling) usually make it the preferable aluminum pigment to employ for all classes of work.

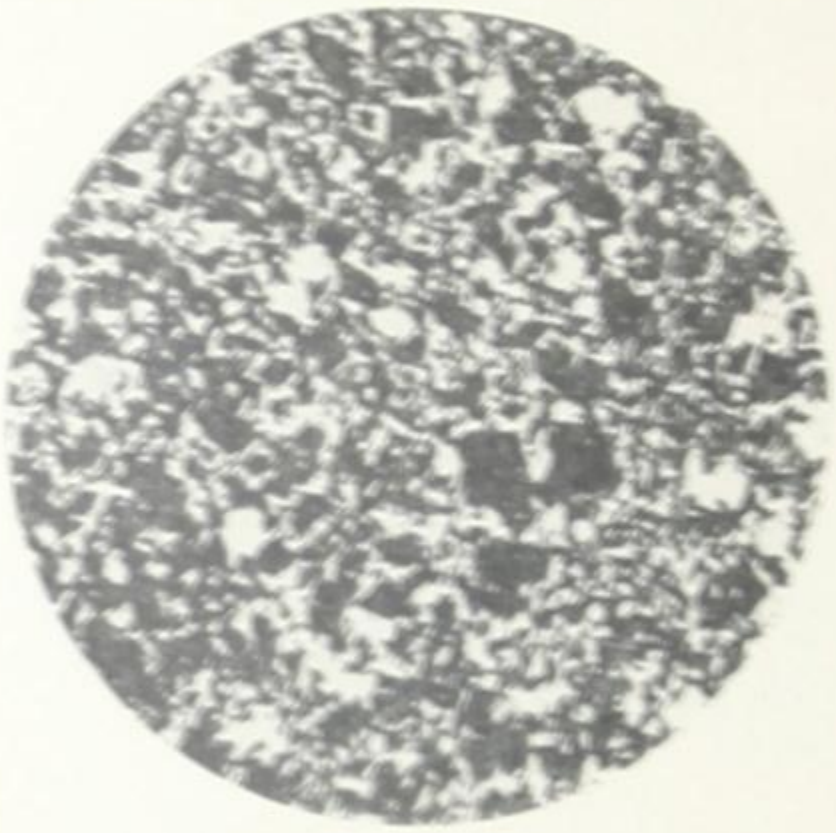
Of the four grades of Alcoa Albron Paste now available, Standard Paste No. 205 is the most widely used. Aluminum paints made with it are durable and produce smooth brilliant films that effectively resist dirt collection, thus retaining their high light reflectivity for a long period.

Extra Fine Lining Pastes No. 1570 and No. 1571 are both of the same mesh size and fineness. The paints made with either of these grades give considerably smoother finishes than those made with Standard Paste. The No. 1571 Paste differs from the No. 1570 grade in the nature of the volatile paint thinner employed; the thinner in Extra Fine Lining Paste No. 1571 is compatible with nitrocellulose lacquers and certain synthetic resin varnishes. This grade should be used in vehicles that do not permit thinning with mineral spirits.

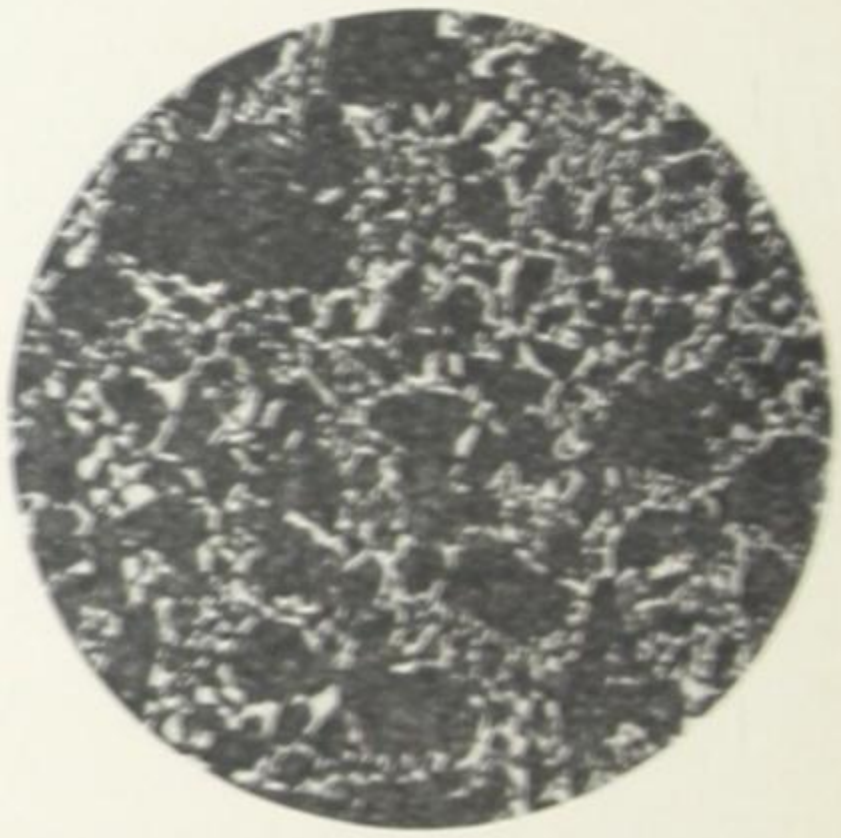
Extra Fine Lining Ink Paste No. 1572 is similar to Extra Fine Lining Paste No. 1570 in particle size, but because of its higher pigment content is quite dry and not so readily dispersed in a vehicle. Its use is confined principally to the production of inks and polychromatic finishes, where the best leafing is not required.

Aluminum Powder—Of the 13 or 14 grades of Alcoa Albron Powder produced by the stamping process, only five are of any importance as paint pigments. The others are used for various chemical and industrial purposes or for decorative coatings outside the painting field.

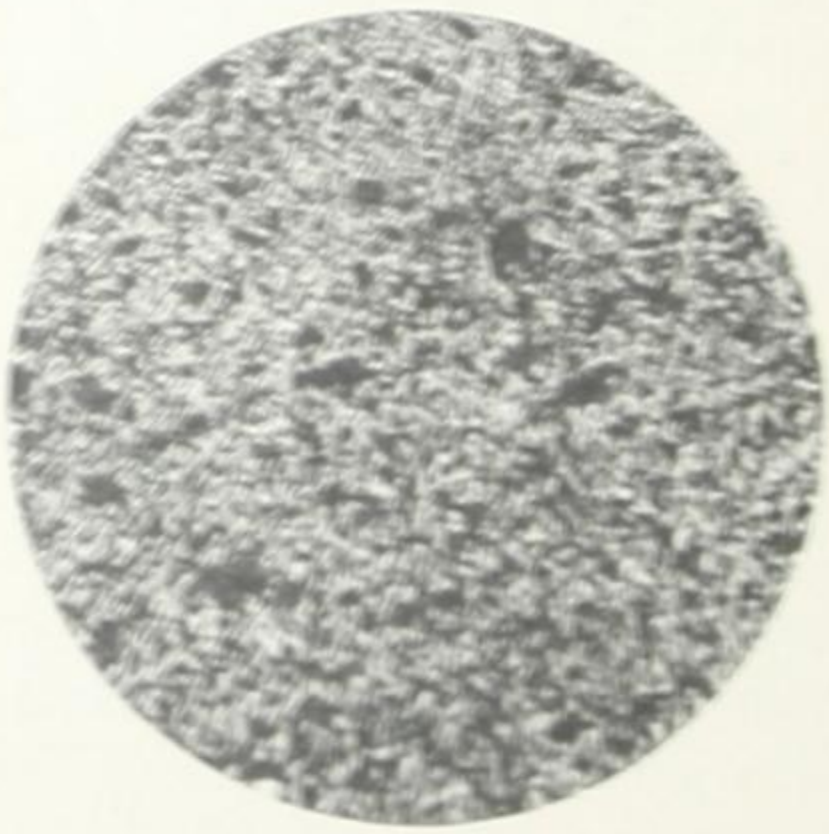
The three "varnish" grades of Alcoa Albron Powder differ from one another principally in the maximum particle size as determined by the mesh of the commercial screens through which they are sifted during manufacture. Extra Brilliant Varnish Powder No. 301 is the coarsest and in a paint film produces a uniformly rough, bright finish with good light reflecting properties.



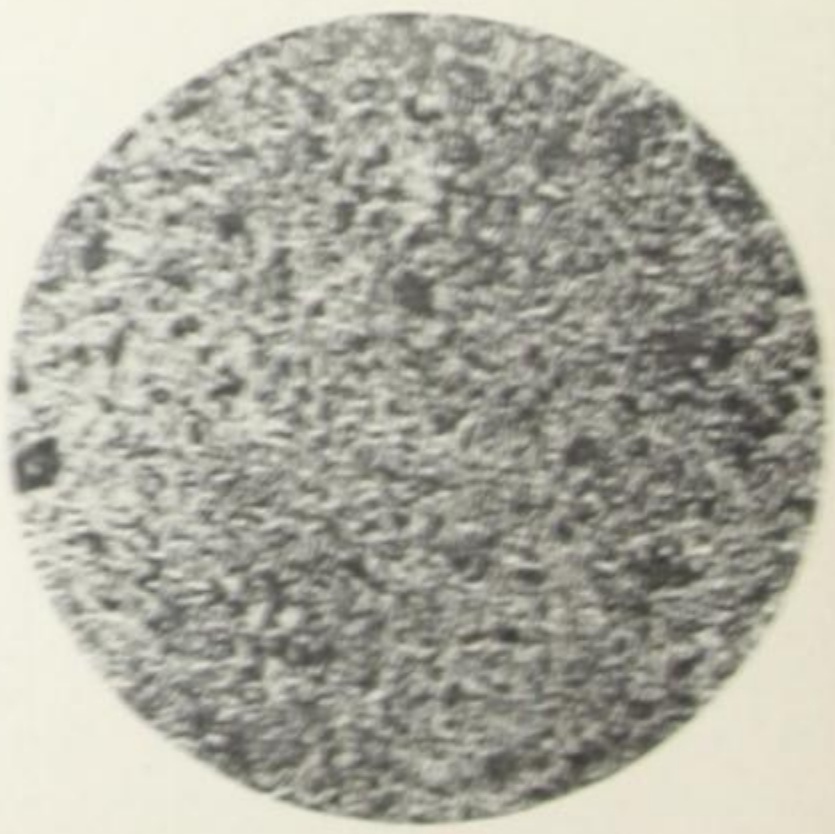
Right:
Alcoa Albron
Standard Varnish Powder
No. 321



Left:
Alcoa Albron
Standard Paste No. 205

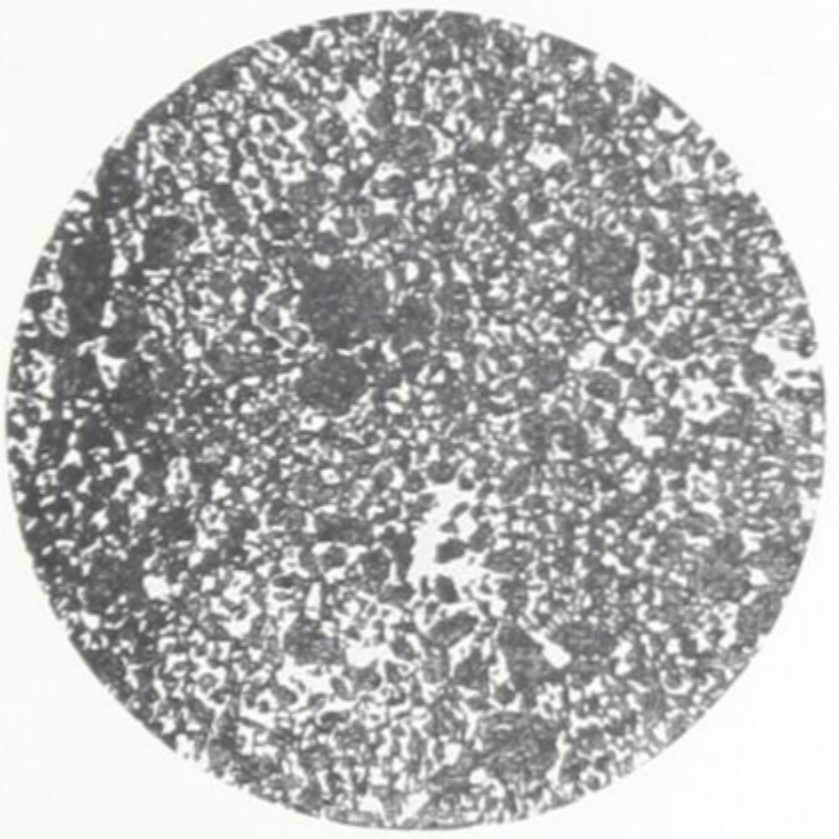


Right:
Alcoa Albron
Extra Fine Lining Paste
No. 1571

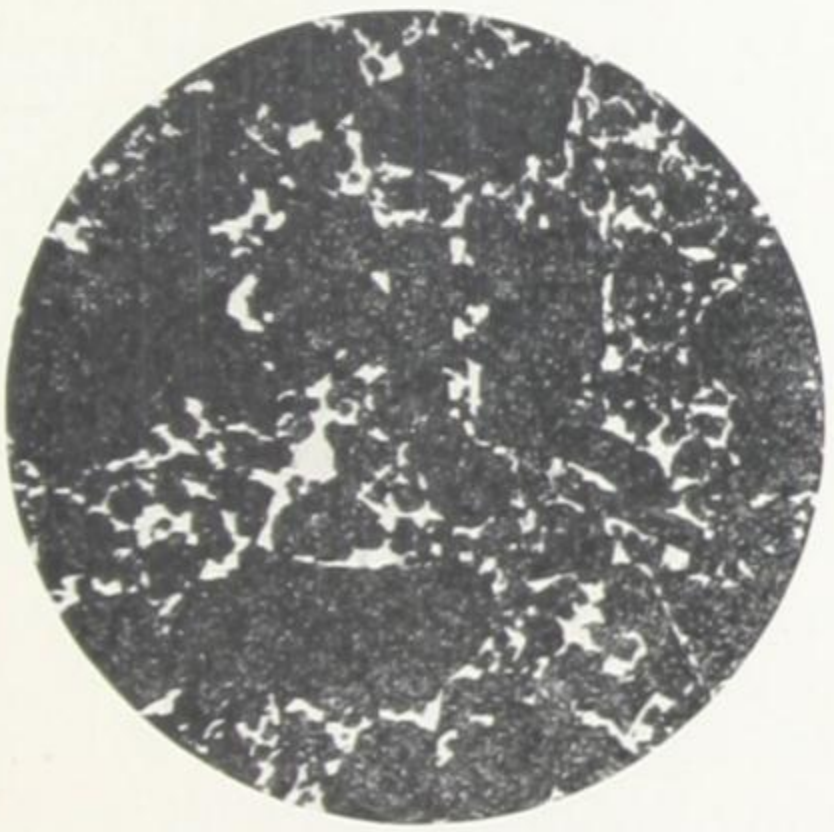


Left:
Alcoa Albron
Extra Fine Lining Paste
No. 1570

These photomicrographs taken by transmitted light show the particle size distribution of the various paint grades of Alcoa Albron Paste and Powder. They do not repre-

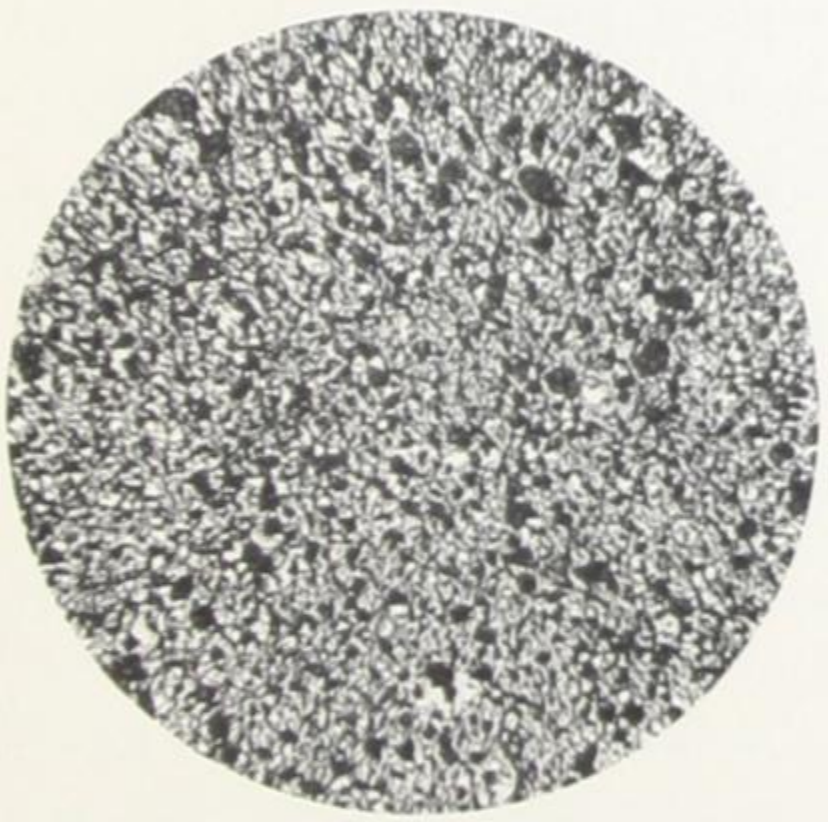


Right:
Alcoa Albron
Standard Lining Powder
No. 408



Left:
Alcoa Albron
Extra Brilliant Varnish
Powder No. 301

Right:
Alcoa Albron
Extra Fine Varnish
Powder No. 341



Left:
Alcoa Albron
Extra Fine Lining
Powder No. 422

sent aluminum paint films, but are photographs of the flakes of each grade dusted one layer thick on water. The dark irregularly-shaped areas are the aluminum flakes.

Standard Varnish Powder No. 321 is appreciably finer and contains a larger percentage of very small flakes. Consequently, paints made with this grade are not only more durable on weather exposure, but also the finish is considerably smoother. Standard Varnish Powder is the most widely used of the powder grades and is recommended for general-purpose applications. It meets the requirements of Federal Specification TT-A-476, Type A, and other state and government specifications calling for a 100-mesh powder. Extra Fine Varnish Powder No. 341, as its name implies, is still finer and when used in a paint supplies a film of good color and hiding power, with a texture that makes it particularly suitable for use as a production finish on manufactured articles.

Standard Lining Powder No. 408 and Extra Fine Lining Powder No. 422 were developed for use where a finish of maximum smoothness and appearance was desired. Because of the very small thin flakes of these two grades, they both possess high pigment value and may be used in much smaller quantities in the vehicle. The finish obtained by the use of Standard Lining Powder No. 408 is similar to that obtained with Standard Paste No. 205 in smoothness, while the color is slightly darker and more brilliant. The Extra Fine Lining Powder No. 422 makes a finish which is comparable with that obtained by the use of the Extra Fine Lining Pastes, but which is more brilliant, and looks much like chromium plating when the coating is sprayed on a polished metal surface. Spray application is the best method of obtaining a smooth bright coating with this grade of powder.

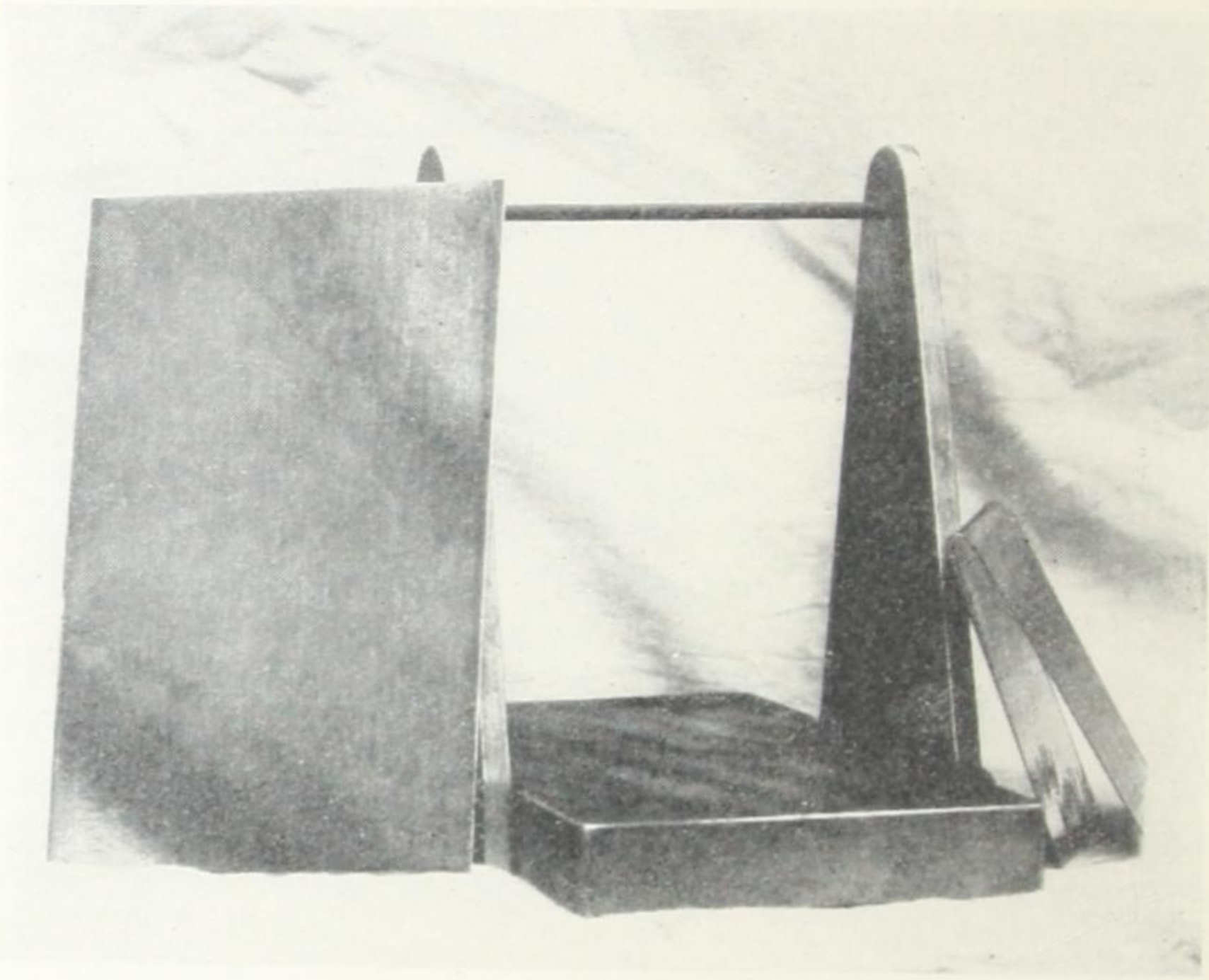
VEHICLES FOR ALUMINUM PAINT

ALUMINUM PAINT has been found desirable for a large number of different applications and since the characteristics of the surfaces vary as well as the exposure conditions, it has become necessary to develop vehicles that will satisfactorily meet all possible services. This discussion of vehicles will be limited chiefly to those that have the widest utility and are readily available. For purposes of reference, these liquids have been given descriptive names, but it is important to keep in mind that such names are not always used by the paint and varnish manufacturer when such products are offered for sale. However, information regarding the properties of aluminum paint vehicles offered under proprietary names and code numbers can usually be obtained at their source. The importance of selecting the right vehicle for the job cannot be overemphasized and is as vital as the securing of the best type of aluminum pigment. Care in choosing *both* will most surely produce the desired results.

TECHNICAL TERMS

A word of explanation concerning some of the terms used in describing vehicles may be helpful. By the "length in oil" of a varnish is meant the proportion in gallons of heat treated drying oils (such as China wood or linseed oils) to 100 pounds of varnish gums. A ten gallon varnish contains ten gallons of drying oil for every 100 pounds of gums dissolved in it. This would be considered a "short oil varnish." A 35 or 40 gallon varnish is considered to be "long in oil" and presumably more elastic and durable on weather exposure.

The Kauri Reduction Test is a measure of the elasticity of a varnish and is useful in predicting its ultimate durability. The Kauri Reduction Value is expressed as a percentage and the more elastic vehicles show the higher values. The Gardner-Holdt tubes are used in making a comparison of the consistency or viscosity of a varnish with that of liquids of known viscosities; the results are expressed in "poises" which is the name for the unit of viscosity. The term "acid number" refers to the measured



Kauri Reduction Test panel before and after bending. See specifications on page 86 for test information.

quantity, in cubic centimeters, of a standard solution of alkali necessary to just neutralize the acid content of the varnish and may give some information regarding the nature of the ingredients in the varnish, as well as the care taken in its preparation.

The nonvolatile content of a vehicle is the proportion of solids or film-forming constituents in a varnish. The balance is usually thinners such as mineral spirits or turpentine.

The "setting to touch" time is a measure of the time it takes a varnish or paint to dry to a point where the film, while still slightly tacky, will not soil the finger when touched lightly. If the setting to touch time is too slow, the paint may collect dust and insects or be easily ruined by a sudden rain. If the time is too fast, the painter may experience difficulty with brush marks and laps.

Most of the vehicles suitable for use in making aluminum paint

fall into three general classes,—those having a drying oil-resin base, those containing nitrocellulose as the film-forming base, and those formulated with pitch or asphalt. The principal types will be briefly described; their detailed characteristics will be found in the vehicle purchase specifications that are given, beginning on page 86.

The oil-resin class, sometimes called oleoresinous varnishes, vary from each other chiefly in their elasticity, their moisture and chemical resistance, and durability. Each also may possess some special property that makes it particularly useful for its selected field of application, but limits its use in other work.

Long Oil Varnish—This type of vehicle is usually between 40 and 50 gallons in oil-length and should produce an aluminum paint that dries to a hard, abrasion-resisting film of good elasticity and durability. It is recommended for use on weather-exposed metal surfaces and for the painting of the interiors of buildings subject to severe moisture conditions. It is not suitable as a priming or finishing coat for weather-exposed wood. It should meet the requirements of the specifications given in paragraph 12, page 86.

Phenolic Resin Base Varnish—This type of vehicle is known as a "synthetic resin" varnish and possesses unusual properties. It dries to a harder film than the long oil varnish but has much better elasticity and durability. Its moisture and chemical resistance are excellent and, because of its elasticity, it may be used as an all-purpose vehicle for aluminum paint on both metal and wood, exterior and interior. The somewhat higher cost of this vehicle is more than justified by the better protection it offers under severe conditions of exposure. The vehicle should meet the requirements of the specification given in paragraph 13, page 87.

Glycerol-Phthalate Base Varnish—This type of vehicle, also known as an Alkyd Resin Base Varnish, offers improved elasticity and durability. Its rapid drying characteristics make it especially suitable for production finishes, but it may be used with equally good results on weather-exposed wood and metal surfaces. It is not recommended for the painting of concrete or other surfaces that may have an alkaline reaction. It should meet the require-

ments of the specification given in paragraph 14, page 88.

Interior Varnish—For some purposes the use of the higher priced vehicles is not necessary. The Interior Varnish, described in paragraph 15 of the specifications on page 90, is an excellent vehicle for painting any unheated surface not exposed to the weather or severe corrosive conditions. It should never be used as a priming coat for wood out-of-doors and its life on metal under such conditions is usually short.

Very Long Oil Varnish—When aluminum paint is used as a priming coat on wood, the vehicle should be more elastic than is usually necessary for other classes of work. This varnish was developed to comply with this necessity. It is usually 60 to 80 gallons long in oil and, in most cases, too soft-drying to be altogether suitable for painting metal. On wood, however, this varnish gives excellent service; its greater oil content enables the coating to follow dimensional changes without cracking or flaking. It should meet the requirements of the specification given in paragraph 16, page 91.

Heat-Resisting Varnish—This liquid is a special varnish that contains little or no drying oil, as a rule, but consists principally of a varnish resin dissolved in a paint thinner. Aluminum paint made with such a vehicle will withstand very high temperatures without discoloration or flaking. The use of this type of paint should be confined to surfaces protected from the weather, and it is *not* recommended for painting stacks or stack breechings. The varnish should meet the requirements of the specification given in paragraph 18, page 91.

Bituminous Base Varnishes—The use of aluminum paste and powder in certain varnishes that contain as one of their principal ingredients coal tar, pitch, or asphalt is covered by patents*. The better types make good-appearing durable aluminum paint films. They are especially recommended by their manufacturers for use on composition and metal roofs, for waterproofing concrete and underground wood and metal surfaces and for general-purpose application. They should be used with caution where there is any likelihood of white or light-colored oil paints being

*The Paraffine Companies, Inc., U. S. Pat. No. 1,568,215

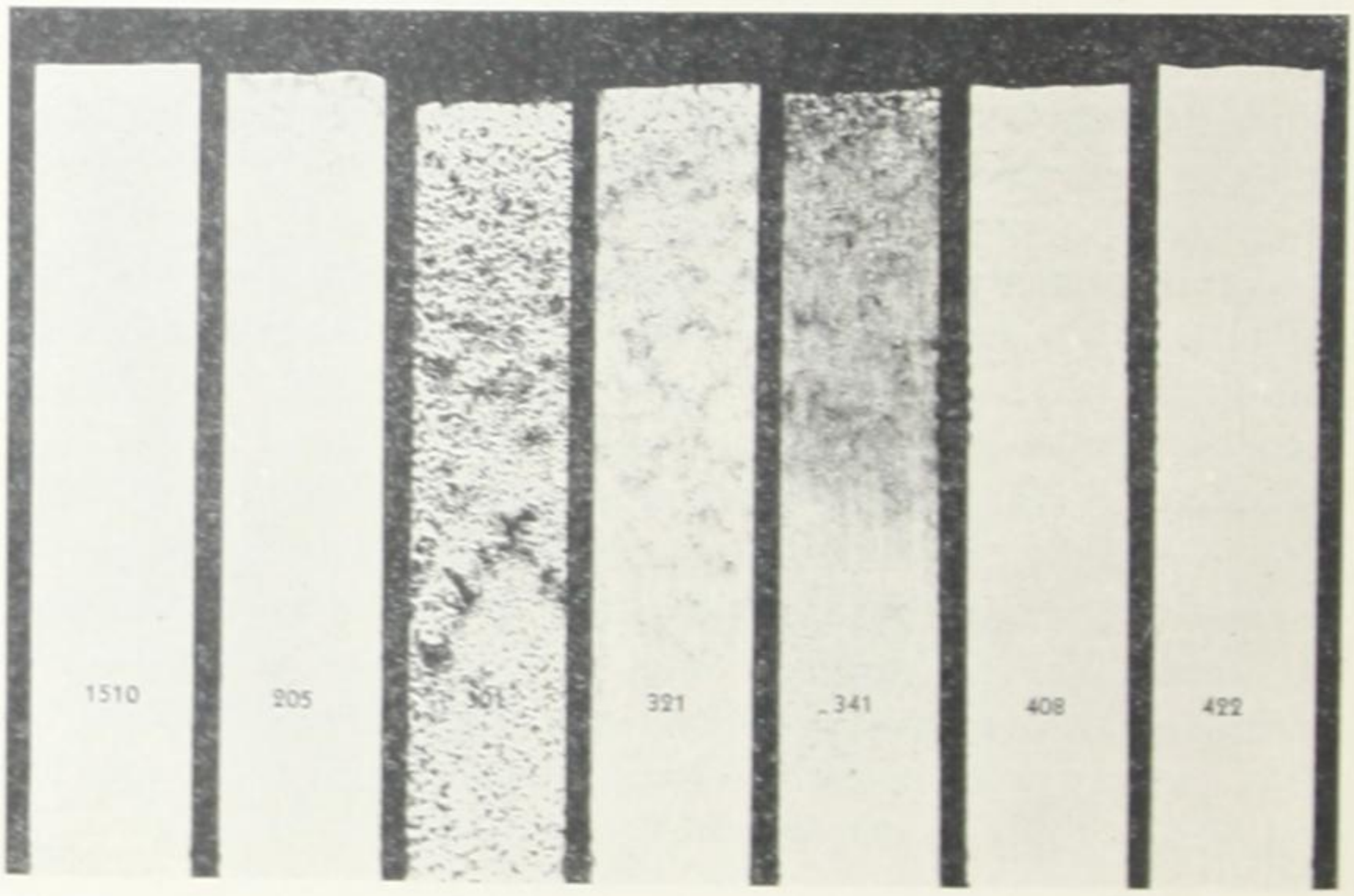
applied over such an aluminum paint, as bleeding of the dark vehicle may occur. See paragraphs 19-D, page 93 and 19-E, page 94.

Gloss Oil Varnish—Gloss Oils, sometimes called bronzing liquids, are frequently used for making aluminum paints for special applications. They might be called zero gallons long in oil since, as a rule, they contain no oil whatsoever. They consist essentially of rosin or some other varnish gum dissolved in naphtha or coal tar thinners. In this respect they correspond to Heat-Resisting Varnishes. In fact, many Gloss Oil vehicles have good heat-resisting properties, although their outdoor durability is low. They are recommended for interior use only and should never be employed on highly absorptive surfaces. They do *not* fulfill the requirements of an Interior Varnish and should never be used as such.

Nitrocellulose Lacquer—The present-day high solids-low viscosity lacquers make durable vehicles for aluminum paints that find many applications, particularly in production work. These lacquers are usually supplied in rather thick consistency, so that the user may dilute up to 100% with the special lacquer thinners recommended by the manufacturer. This type of vehicle is recommended for production finishes where quick drying is essential. Its durability over good priming paints makes it suitable for products that may be exposed to the weather. It should meet the requirements given in the specification paragraph 19-C, page 92.

TESTING ALUMINUM PAINTS

THE QUALITY of aluminum pigment and aluminum vehicles, like other paint materials, must in many cases be accepted on faith in the integrity of the manufacturer unless the facilities of a well-equipped laboratory are at one's disposal. Occasionally application troubles arise that may be laid at the door of the paint being used and, at such times, a few easily conducted tests may serve to locate the difficulty and help to correct it.



Prints made using flow-outs of aluminum paint made with various grades of pigment on cellophane as a negative. Whiteness of the print is a measure of the opacity.

TESTING THE PIGMENT

The better class paint manufacturers and jobbers offer only aluminum pigments of high quality, such as Alcoa Albron Paste and Powder. However, price competition may force onto some dealers' shelves aluminum pigments that are adulterated with mica or made from impure grades of scrap metal. These have low pigment value, are dark in color, deficient in leafing properties,

and require a substantially higher quantity per gallon to obtain even passable results. Since in most cases the lower price at which this material was originally sold is seldom if ever passed on to the user, his cost of the goods tells him nothing of its quality. It can roughly be determined, however, by a few quick tests.

The first thing is to obtain a sample of a high-quality paste or powder that can be used as a standard of comparison for other purchases. Be sure to purchase a recognized grade and nationally advertised brand in the original package. It is important to remember that the pigments to be tested should be mixed in the same vehicle at the same viscosity as used in preparing the comparison standards. The quantities used should be weighed carefully, since they are quite small and consequently magnify even slight errors in weight. Use a stamp scale or a pan balance to insure accuracy.

Appearance—To determine whether the pigment will make a paint of satisfactory appearance, select a good quality varnish vehicle such as the Long Oil Varnish, (See page 86) and make up a mixture of ½ pint of varnish to 2 ounces of pigment. Apply this paint to a window glass panel approximately 8 inches long and 4 inches wide by means of a 1-inch clean varnish brush; flow the coating on evenly and with only enough brushing to assure that all the brush marks lie in the same direction. Dry in a vertical position. The sample of the pigment under test should equal the standard in smoothness and color, and when the glass is held to the light it should show equal uniformity of application and hiding power.

Pigment Value and Leafing—On separate small sheets of glass standing at an angle of 60° to the horizontal, pour a small amount of each of the paints and allow them to run freely from the top to the bottom, making a strip several inches wide and five to six inches long. Allow the panels to dry in this position. When they are held to the light, the tested powder should be comparable in opacity to the standard and should pile up at the bottom of the film to the same extent as the standard. Examine the face of the panels. The bright shining area at the bottom of the film, free

from breaks, should be just as high and complete as the standard and of as good a color.

Settling Test—The settling test is another method of determining the comparative pigment values of different pastes or powders.

To four liquid ounces of naphtha, add one ounce of the standard sample aluminum pigment and stir well. Make a similar mixture with the pigment being tested. Pour the mixtures into separate, similar, clean, medicine bottles; cork and stand on a level shelf. After two hours the pigment under test should not have settled any lower than the standard sample. The pigment that has settled the most in this test is the poorer of the two. This test is a measure of the relative thickness of the powder flakes and their comparative number per pound; the finer the powder, the less is the degree of settling. It is of value only when comparing pigments of about the same mesh size or fineness. A fresh mixture of the standard must be made each time this test is repeated.

TESTING THE VEHICLE

In testing the vehicle a standard sample of varnish helps in making the necessary comparisons. Such samples can be obtained from nationally known paint manufacturers if the specification which the liquid should meet is sufficiently described.

Drying Time—To determine the drying time, mix the standard aluminum pigment in the recommended proportions with the varnish and brush out the paint on the *same* kind of surface on which it will later be applied. Observe the time when the paint is applied, and after each 15-minute interval touch the paint lightly with the finger. When the time comes that by a light touch no paint comes away on the finger, the paint is "set to touch." The dry-hard time is determined by placing the thumb firmly on the surface of the film and twisting it slightly. If the film is not marred by this treatment, it is considered dry.

Leafing Qualities—Pour some of the aluminum paint on a strip of glass held 10° from a vertical position and allow it to stand in this position. After the paint is set to touch, the film should have a well-leafed, uniform, bright surface free from breaks for not less

than half of the length of flow-out or at least equal to the standard vehicle sample.

Retention of Leafing—Set the mixed paints aside in a closed can for 24 hours and repeat the flow-out test (See above). The vehicle being tested should be at least equal to the standard in leafing properties after standing. Brush-outs of the two paints on glass or metal panels should also produce equally bright aluminum paints.

Durability—Testing the durability of aluminum paints on steel or wood panels exposed to the weather is usually a slow procedure. Sometimes, however, an approximate idea of the comparative value of two vehicles can be obtained in a short time by exposure of single coats of the vehicles on steel panels. To make such a comparison, prepare two steel panels by cleaning with naphtha and rubbing with steel wool until the surface is brightly polished. Brush out the unpigmented standard sample of varnish on one panel and the varnish to be tested on the other, taking care to apply both films as nearly equal in thickness as possible. Place the panels on the south slope of the roof of the shop or tack them to the side of the building facing toward the sun. The varnish that permits the bright surface of the panel to tarnish and start rusting first is the least durable of the two vehicles. The area in the center of the panel is the best place to make this observation. The edges and top where the brush strokes begin should be neglected in judging the quality of the liquids. This test may take only four to six weeks and will prove of aid in selecting a future source of supply for durable aluminum paint vehicles.

METHODS OF APPLICATION

MIXING

Care in following the directions given will assure better aluminum paints, smoother films, and easier application with more uniform results. First consult the index of this handbook for the pages that give the aluminum paint formula proportions to be used for the particular surface to be painted. Then carefully estimate the quantity of aluminum paint that will be required for the day's work. Carefully weigh out the required amount of pigment, placing it in the bottom of a container large enough to more than accommodate the entire mix. Do not measure the pigment or guess at the quantity. In a separate container measure out the correct amount of vehicle to go with the pigment. Pour the vehicle over the pigment; never add the pigment to the vehicle. It is important in breaking up the paste pigment and dispersing it properly that at first the vehicle be added in *very small amounts and each small quantity thoroughly mixed* before more is added. Use about 10% of the volume of vehicle for the first addition, 10%

Directions for MIXING Aluminum Paint.

(1) Consult index for correct formula. (2) Weigh pigment accurately. (3) Place pigment in bottom of large mixing container. (4) Add 10% of measured vehicle. (5) Thoroughly incorporate vehicle and pigment; repeat these small vehicle additions until paint flows readily in can. (6) Add remainder of liquid and box. (7) Strain through cheesecloth.

for the next addition, 20% for the next, and then pour in the balance. The mixture is then stirred and "boxed" by pouring the paint from the mixing container into the vehicle container and back again several times. Strain through cheesecloth or an old flour sifter as a final operation to be certain that there are no lumps of unwetted pigment still remaining in the bottom of the container. The paint should be stirred during application, but this stirring should be moderate and no more than is necessary to keep the pigment in suspension. Too much agitation darkens the paint and destroys leafing. It is important, however, that the paint in the mixing container be stirred each time any of it is removed, in order to assure uniformity of mix on the entire job.

TINTING ALUMINUM PAINT

Aluminum paint may be tinted with other pigments to obtain different metallic color effects. One of the chief purposes of tinting is to secure a good contrast between succeeding coats of aluminum paint in order that the second coat will be uniformly applied. Such paints may also be employed for their decorative effect. Practically any colored pigment may be used for this purpose though some give more color change than others, depending on their tinting strength. To obtain strong tints, the proportion of aluminum pigment may be reduced. Allowing the mixed tinted paint to stand 24 to 48 hours will intensify the color and produce more uniform and consistent results.

The tinting pigments which have been found to give the best results are as follows:

Prussian Blue produces a deep blue tint (recommended for best color contrast).

Chrome Green produces a green tint.

Chrome Yellow produces a light green tint.

Yellow Ocher produces a light yellow tint.

Carbon Black produces a gun-metal gray.

Lead Carbonate produces a battleship gray.

Spanish Iron Oxide produces a light pink tint.

Toluidine Red produces a rose tint.

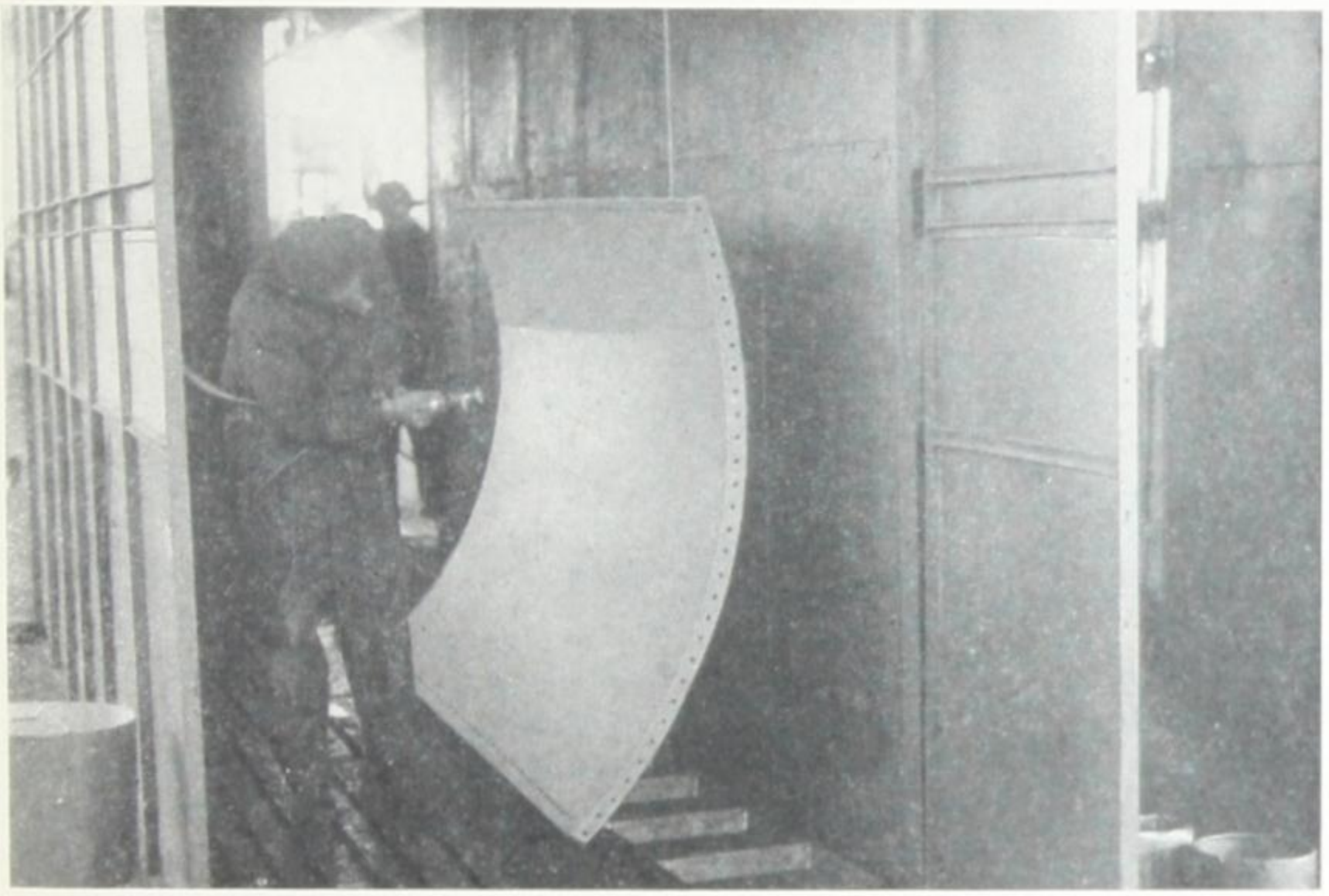
The tinting pigments should be added to the vehicle and thoroughly incorporated before the vehicle is mixed with the aluminum. A few experiments by the user will give the exact quantities necessary to obtain the desired effect. Incidentally, the durability of these tinted aluminum paints compares very favorably with untinted aluminum paint, provided the amount of aluminum pigment is not reduced more than 20 per cent. The permanency of color of these paints depends entirely on the resistance to fading of the tinting pigment.

APPLICATION

The choice of the manner in which aluminum paint may be applied is not limited by the nature of the paint, since, as has already been pointed out, all of the standard methods of application are in successful use today. Some suggestions concerning the way these methods are most efficiently employed may be helpful.

BRUSHING

The brush should be not over four inches wide and made of long bristles of good quality. Short stiff bristles lead to overbrushing of the film and produce deep unsightly brush marks. The paint should be applied to the surface in the usual manner and well brushed out to a thin film, using minimum pressure. All final brush strokes should be made in the *same direction* and toward the lap with the previously applied paint. Do not start a return stroke beginning with the lap as this will inevitably leave a small excess of paint at the beginning of the stroke which will dry with a different sheen and make the work look "blotchy." Once the paint is brushed out and the final wiping strokes toward the lap made, *do not touch the work or go over it again no matter how nonuniform it may appear*. If the paint has not been overbrushed and the setting time is not too fast, this nonuniformity will disappear in four or five minutes and the film will dry out smooth and brilliant. However, if the brush is run over aluminum paint that has begun to leaf and set, it disturbs the pigment particles that have come to the surface, pushing them under

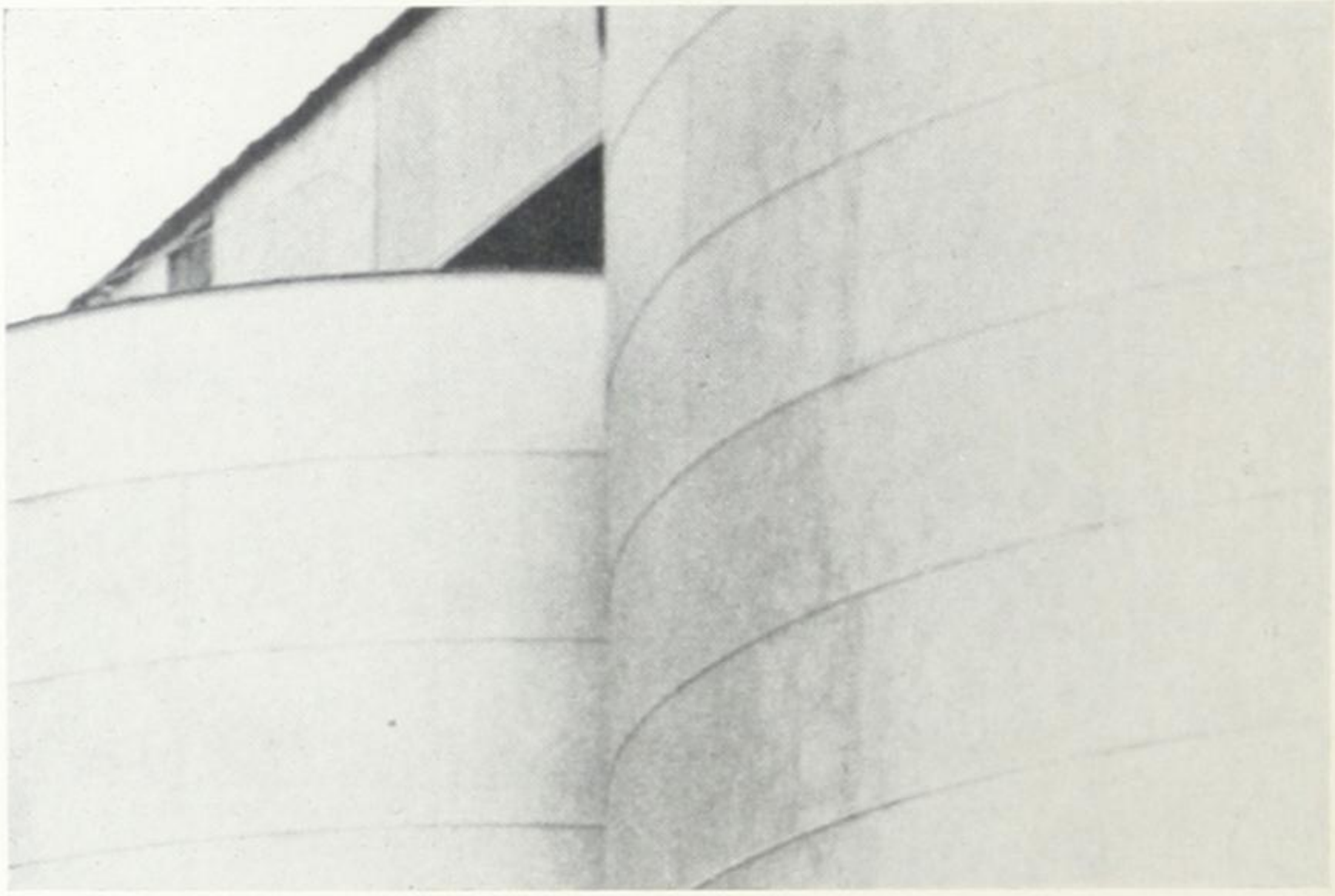


Production spraying of tank sheets with aluminum paint.

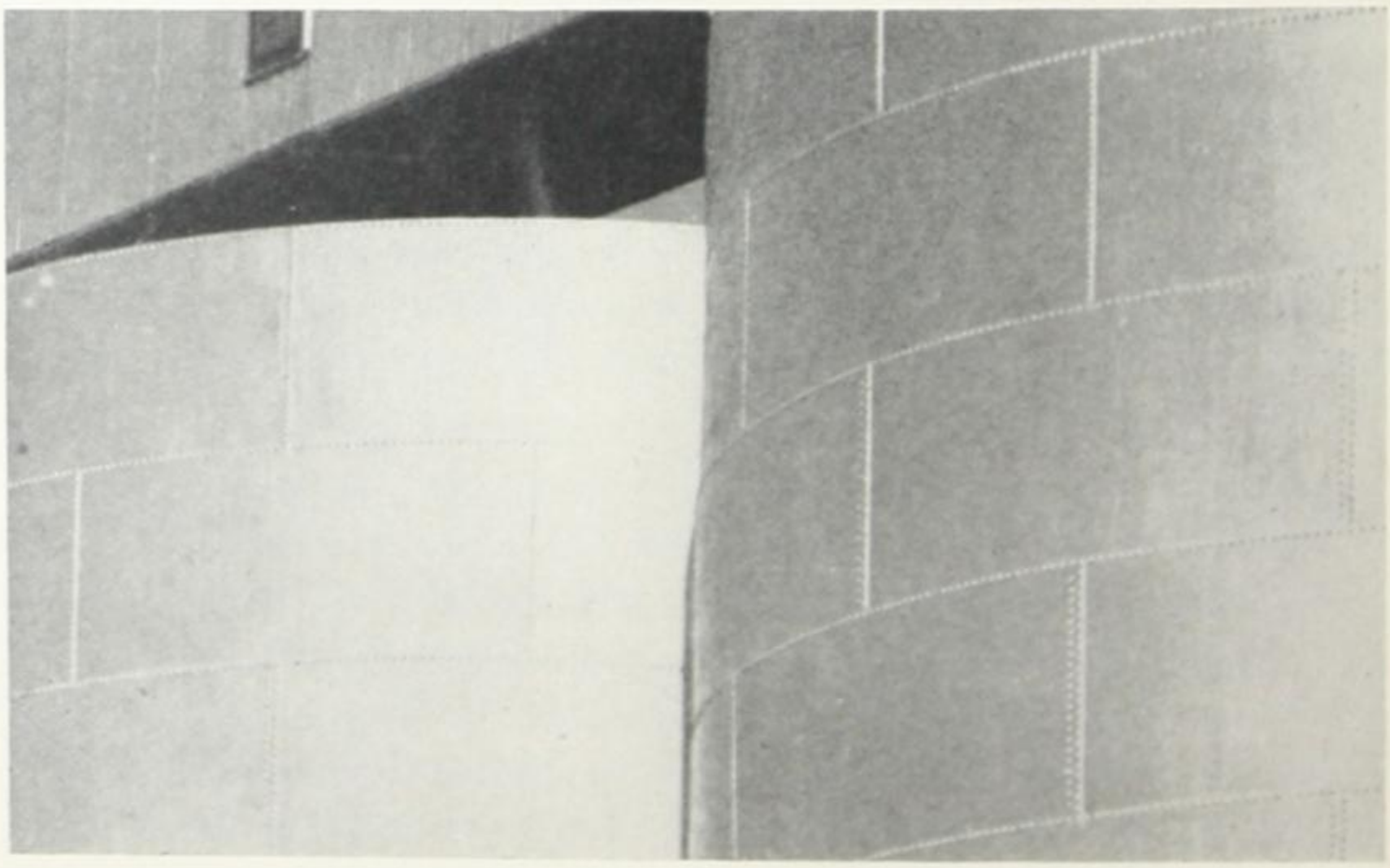
again. Because the film is losing volatile thinner rapidly by this time, the consistency of the vehicle has been greatly increased and the coating is now too viscous to permit the powder flakes to move freely in the liquid. The disturbed leafed area is therefore never completely replaced. This results in a strongly contrasting dark-colored streak that stands out with disagreeable distinctness against the brilliant, leafed surface on either side. For best results brush the paint on, lay it off, and then *leave it alone*. It will look all right when it is dry.

SPRAYING

Where there are large flat surfaces to be painted, the spray gun is the best tool to use in applying aluminum paint. It permits the spreading of a uniform film, free of brush marks, and gives maximum leafing. There are air gun nozzles developed specially for use with aluminum paint and they are similar to those used for applying heavy oil base paints and enamels. Spray guns that operate at low pressures with high air volume are more efficient

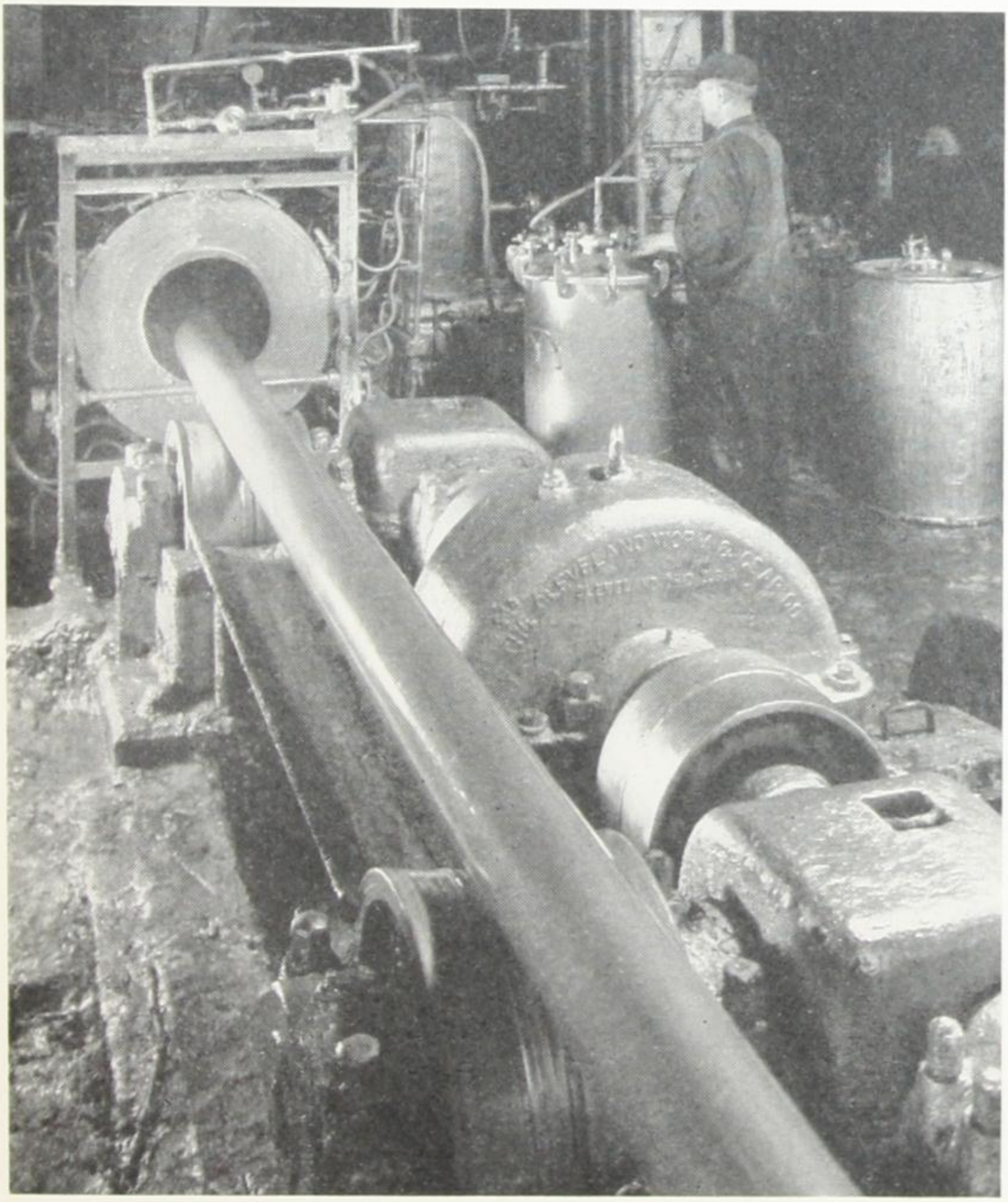


This illustration shows the effect obtained when aluminum paint is overbrushed in application. Note laps and streaks.



This illustration shows the effect obtainable by proper brush procedure which gives a smooth uniform finish.

with aluminum paint because it is easily atomized. Too high a nozzle pressure causes excessive losses. The pressure on the tank can be held at any value necessary to get good operation. The width of the spray should not exceed 18 inches and should preferably be limited to about 12 inches in order to avoid "fogging." Do not use air agitation in the tank as this will cause some



Production coating of steel pipe with aluminum paint.

vehicles to thicken and is also detrimental to leafing. An occasional turn or two on the hand agitator during continuous operation is sufficient to keep the paint uniform, but the paint should be well stirred if there is a long interruption such as occurs at the lunch hour. The paint should be blown back out of the material hose at this time or the settled pigment may cause clogging of the gun when spraying is resumed.

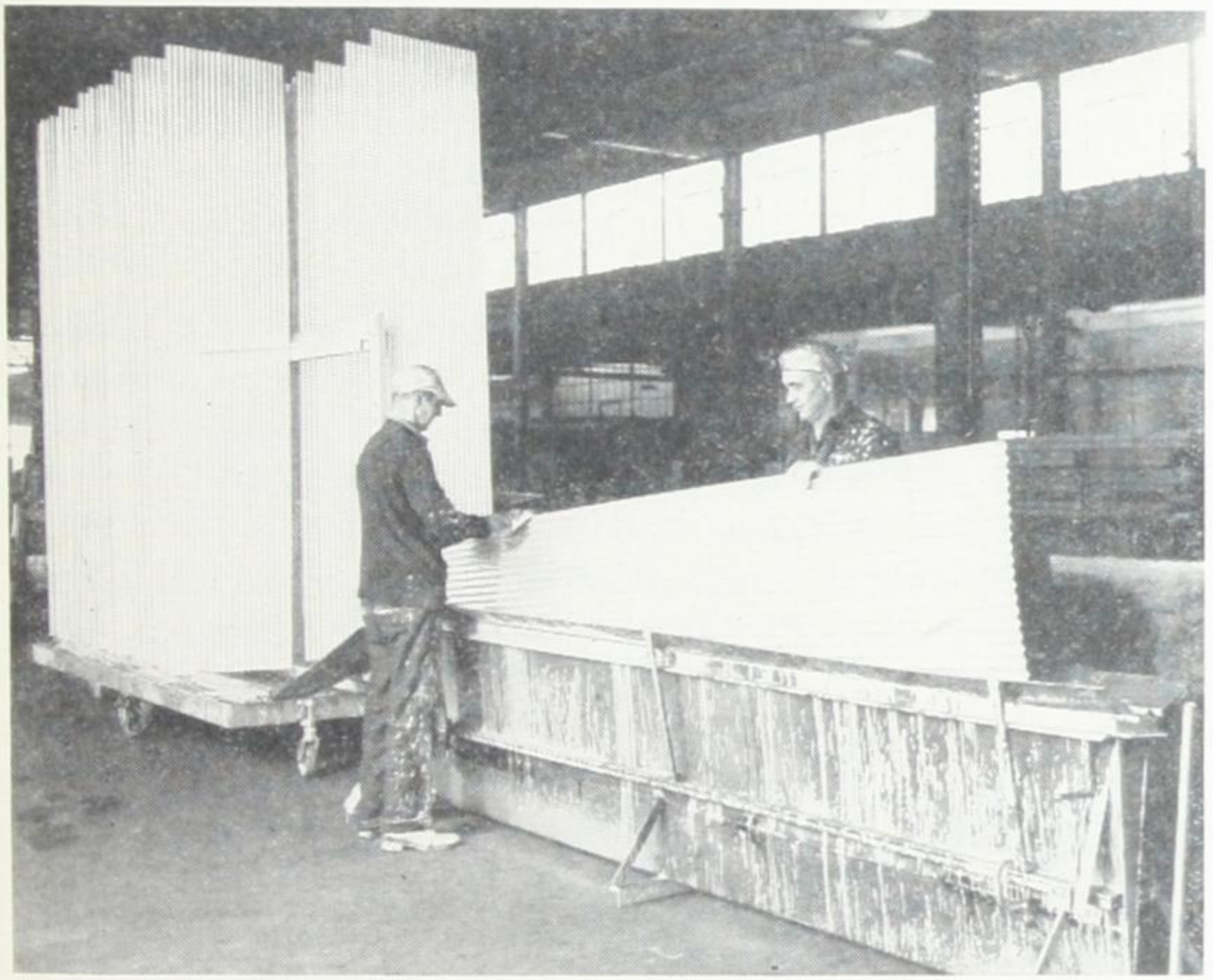
The high hiding power of aluminum paint may lead the operator to skimp the work and apply a film inadequate in thickness. If coverages are averaging better than six hundred square feet per gallon, the film is too thin and the gun should be opened up one or two turns. Too thin a film of aluminum paint will dry flat with a whitish, dusty cast, while a good wet film dries with the full bodied brilliance characteristic of the brush job.

Should any paint remain in the mixing tank after the day's work, it may be mixed in with the freshly prepared paint, provided it does not exceed 10% of the volume of the new paint. In this manner the old paint may be used without spoiling the appearance of the work because of changes in color. It is advisable, however, to avoid adding more than 10% at any one time unless tests indicate that the leaf-retention properties of the vehicle being used are better than average.

DIPPING

Aluminum paint may be applied by dipping, and this method of coating manufactured products is recommended where the volume of work justifies it. Vehicles for dipping purposes must be almost tailor-made to suit each particular job. The paint manufacturer must formulate the liquid so as to have the correct flowing and baking properties and the leaf retention of the vehicle must be exceptionally high. These requirements often make necessary the use of a lower oil content varnish of rather thin consistency, the subsequent baking operation helping to offset the lower durability characteristics of such a film. A number of such vehicles have been developed and are being successfully used on many different types of products.

It is important that the article to be dipped be free from



Coating corrugated metal sheets with aluminum paint by dipping.

grease or the paint will not wet the surface. It may be cleaned by dipping in a hot solution of tri-sodium phosphate and washing in clear hot water; the heat from the water aids in the drying after the piece is removed. Dipping in the paint may be done by hand or by the use of special machines designed for the purpose. The rate of withdrawal in many cases must be carefully controlled, since the surface tension of the liquid effects a wiping action that removes excess material and helps to reduce dripping losses, runs, and sags. A rate of withdrawal of about six to twelve inches per minute will usually produce good results. This factor is not so important on small objects, since the distance the paint must flow is so small as to be negligible.

The paint should be of such consistency that the work will drain free of droplets and fatty edges. Certain special solvent combinations of the correct evaporation rate aid in securing this

result. The drying time must be adjusted so that complete leafing takes place before initial set, but must not be so slow as to produce soft, poor abrasion-resisting films when the coating is dry enough to handle. Baking at high temperatures improves the appearance by keeping the vehicle plastic and aids in closing up broken areas.

The coarser grades of powder are not suitable for dipping operations because of their lower pigment value and the poor flowing properties of the resultant paint. The best results will be obtained with pigments having a mesh size similar to Extra Fine Lining Powder No. 422 or Standard Lining Powder No. 408.

Dipping should not be selected as the means of applying aluminum paint unless daily replacements of new paint are high. The smaller the volume of paint in the dipping tank, the better the results will be. New paint should be added daily in amounts of about 25% to 40% of this volume if the finish is to be uniformly bright and of good color. With vehicles of exceptionally good leaf-retention properties, this quantity may be reduced to as low as 10%. Tests should be conducted on the paint before definitely selecting the dipping method.

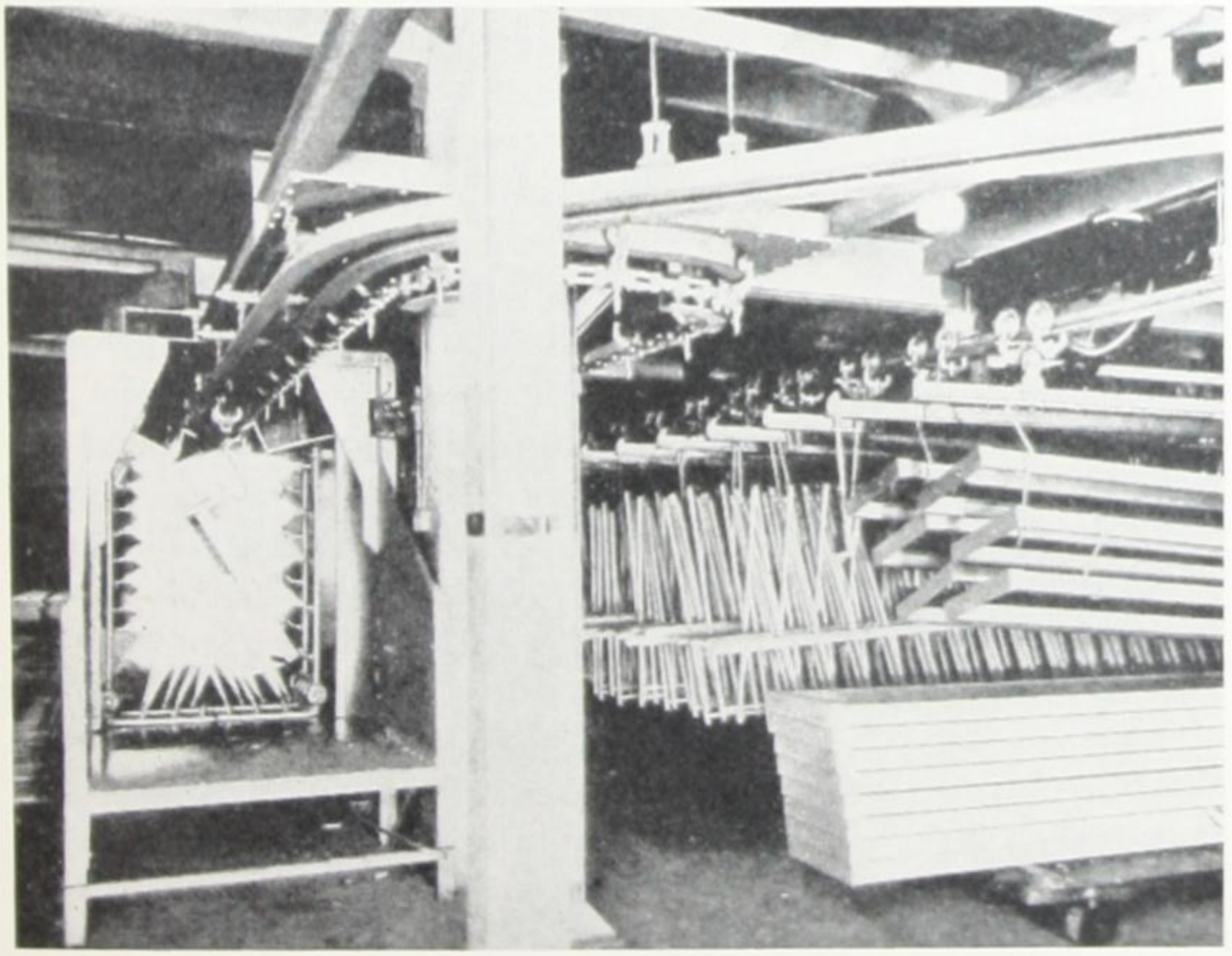
The paint in the dipping tank should be kept clean and free from skins and sediment. An occasional cleaning of the tank is recommended and the paint should be strained at suitable intervals or the collection of debris will eventually contaminate the mixture to such an extent as to render it unusable. When the dipping tank is not in use, it is a good idea to keep it covered with a sheet of butcher's wrapping paper. The paper should be allowed to come in contact with the entire surface of the paint, where it will serve not only to keep out dirt but also to prevent the formation of undesirable skins and reduce oxidation and solvent evaporation. The paper can be removed and thrown away each time the tank is put back in service; the small expense is well worth the trouble and time it saves.

A *slow-moving* agitating device will serve to keep the pigment in suspension. Do not use air agitation as it tends to thicken the paint and its oxidizing effect destroys leafing of the aluminum pigment. With the very fine lining powders, the stock being

dipped produces enough agitation without the employment of mechanical stirrers. In such cases there is practically no danger of serious settling difficulties if the paint is given an occasional treatment with a hand-operated wooden paddle.

FLOW COATING

A modification of the dipping method is the application of aluminum paint in a flow coating machine. These machines are especially designed to flood on or spray a large volume of paint over the object; the excess drips off and is recovered in a sump from which it is returned to the system. The advantage of this method lies in the comparatively small volume of aluminum paint necessary to keep it operating, thus permitting frequent replacements of fresh paint which keep the leafing quality up to standard.



Steel frames being coated with aluminum paint by passage through a flow coating machine.

The flow-coat method is recommended where dipping would not be practical because of the depth and volume of the tank necessary to hold the piece to be painted. The same precautions must be followed as in dipping if good results are to be obtained. The replacement volume must be large, the paint must be kept strained and clean, and the work must be grease free. The liquid used should have the same flowing, leveling, and leafing properties that characterize a good dipping vehicle and it must be particularly resistant to bodying, since more surface is exposed to air by the circulating system than is the case in a dipping tank.

ROLLER COATING

Decorative coatings of aluminum paint may be applied to sheet metal by roller coating machines. This method is a modification of the printing press, and when used with a specially formulated varnish vehicle and aluminum pigment, produces striking results. Only the finest paste or powder will work satisfactorily in such equipment and the vehicle used must be carefully adjusted to have the right flow and baking properties. The coating should bake hard in a very short time and should have the solvents and thinners so formulated as to prevent the material from becoming tacky on the coating rolls. The flow should be sufficient to level out all roll marks in the film before the initial set takes place, but the liquid should not be so fluid as to permit the formation of breaks when the work is dried or baked in a vertical position.

In the operation of the machine, the flat sheet is passed under a composition roll which has been coated with a uniform wet film of aluminum paint by two adjacent smaller rolls, the coating material being fed to the first of these distributing rolls from a trough or fountain. By adjusting the pressure of the distributing rolls and the pressure of the coating roll any practical film thickness can be obtained. The coated work passes automatically into an oven on an endless conveyor system where each sheet, held upright and separate from its neighbor, is baked to a hard abrasion-resisting finish. The sheet may be later fabricated and drawn to form containers, toys, or other production articles.

BURNISHING

The appearance of solid aluminum metal may be given to any smooth nonabsorbent surface by the use of fine lining powders dusted onto a tacky size. Extra Fine Lining Powder No. 422 seems preferable to the other grades because of its color and extremely small particle size. If the surface is absorbent, it should first be filled with several coats of shellac or hard drying spar varnish and then sanded lightly to produce a slightly rougher finish. Apply a coat of Gloss Oil Varnish (See page 25) and allow it to become dry to a point that it will string and lift with the finger when touched. When this point is reached, the aluminum powder is dusted on the surface in a thin uniform layer. For convenience, the powder may be held in a large salt shaker over the holes of which has been tied a single thickness of cheesecloth. The container should not be more than three-quarters filled and the powder will readily pass through the holes in the shaker top and be broken into a fine dust by the cloth.

When the size is completely dry, the surface should be briskly rubbed with a very fine lint-free soft cloth after first wiping away the excess powder with a new, soft, bristle brush. Care should be taken that the rubbing is carried out in a uniform manner and that the friction does not develop heat sufficient to soften the coating. When the work has been burnished to a smooth finish, it should be protected by a coat of clear lacquer or varnish. If the coating cannot be sprayed on, a thin coat of water-white Glycerol-Phthalate varnish may be *flowed* on with a brush. The thinnest protective film that will prevent rubbing of the aluminum powder will give the truest metallic effect.

DIRECTIONS FOR THE USE OF ALUMINUM PAINT ON VARIOUS TYPES OF SURFACES

General Instructions

ALUMINUM PAINT may be easily prepared by mixing the pigment and vehicle in the quantities required. (See page 30.) It may also be purchased in ready-mixed form, but the qualities of the ready-mixed paint should be checked, before using, to see if it equals in leafing, covering, and general appearance a good freshly-mixed aluminum paint. If the paint is to be job-mixed, only sufficient quantities should be prepared for one or two days' use. Paint left over may be added to newly-mixed paint without seriously affecting the leafing properties, provided it does not exceed 10 to 15 per cent of the volume of the fresh mixture. The paint after mixing should be kept in a closed, airtight container when not being used and should be stirred thoroughly each time any is removed. During application, stir the paint no oftener than necessary to keep the pigment in suspension. Too much agitation will affect leafing and color.

PREPARATION OF SURFACE

Thorough cleaning of the surface to be painted may represent over half the cost of the job, but no satisfactory work can result unless this important operation is correctly done. The surface must be free from dust, dirt, and grease. On new steel, the mere removal of grease and dirt, although important, is not always sufficient to insure good paint adhesion. Paint will not adhere satisfactorily to a surface on which there is loose mill scale or any appreciable amount of rust. The dust and dirt may be removed by brushing and the grease by washing with mineral spirits or gasoline. A strong solution of soap and water, followed by a clear water rinse may also be used. The surface should be allowed to dry thoroughly.

After removal of grease and dirt, steel surfaces should be

freed from rust and scale as thoroughly as possible. There are various means of accomplishing this, but one of the most efficient is by sandblasting. If sandblasting is employed, the surface should be primed as soon as possible thereafter to prevent the formation of additional rust. Where sandblasting equipment is not available, steel scrapers and wire scratch brushes should be employed. On production jobs, pickling in acid solutions is frequently used with good results. Permit the surface to dry completely before applying any paint.

On seacoast locations or around chemical manufacturing plants, most surfaces have on them thin deposits of salt or other water soluble materials. Such substances trapped beneath a paint film lead to premature failure, and thorough washing with clear water to remove such material may double the life of the coating. On old surfaces all loosely adhering old paint and rust should be removed by scraping and scratch brushing. Rust on metal or decay in wood should be cleaned down to a sound surface.

WEATHER CONDITIONS

No paint should be applied at freezing temperatures. The lowest temperature at which aluminum paint can be satisfactorily applied is 40°F. The surface should be absolutely dry and there should be no frost or condensed moisture on it. No paint should be applied to weather-exposed wood for at least twelve hours after a heavy rain where air temperatures are above 60°F. and an even longer time should be given for water evaporation at lower temperatures. If the surface is very cold, it is better to thin the paint slightly in order to improve the brushing qualities. If the surface is very warm, say above 100°F., the addition of a slow evaporating solvent like turpentine or heavy mineral spirits will retard the initial set of the paint and aid in flowing out laps and brush marks.

HANDLING ALUMINUM PASTE AND POWDER

It is important that the handling and storing of quantities of paste or powder containers be given special attention. This subject is covered on page 96.

Aluminum Paint on Wood

Aluminum paint has good durability when used as a priming coat for such woods as southern yellow pine, ponderosa pine, Douglas fir, hemlock, and spruce. Its excellent adhesion to the wide bands of both spring and summer wood found in these species greatly improves the performance of the oil topcoats, adds several years of useful life to the paint job, and assures a good surface for repainting. On red cedar, redwood, and cypress, aluminum primers produce equally good results, but the improvement is not so spectacular because of the better "paint holding" characteristics of these woods. Aluminum paint is also frequently used for both primer and finish coats where the silvery color is acceptable. The durability of a two- or three-coat aluminum paint job on lumber is usually more than twice that of oil paints. This makes it particularly useful for painting houses in industrial towns, summer cottages, and frame factory buildings.

Aluminum paint is efficient in the prevention of bleeding of oil soluble decorative wood stains. Light-colored topcoats usually may be applied over such stains when the correct aluminum paint is used first as an undercoat.

As a primer and second coat on water submerged surfaces, such as wooden boats, floats, and mine equipment, its water-resistant character and good adhesion make it an excellent protective coating and reduce water absorption.

WEATHER-EXPOSED WOOD

Surfaces Painted—	House siding, shingles, fences, trellises, porch flooring, ceiling, etc.
Uses—	As primer or as primer and finish coats
Formula—	Pigment—2 pounds Standard Paste No. 205 (See pages 14 and 17) Vehicle—1 gallon Very Long Oil Varnish (See page 91)
Yield—	1.164 gallons or approximately 1 gallon 1¼ pints
Covering—	500 to 600 square feet per gallon (brushed) 450 to 500 square feet per gallon (sprayed)

Alternate Pigments—1½ pounds Standard Varnish No. 321 (See pages 14 and 20)
1¼ pounds Standard Lining No. 408 (See pages 15 and 20)
*Alternate Vehicles**—Phenolic Resin Base Varnish (See page 87)
Glycerol-Phthalate Resin Base Varnish (See page 88)

WOOD ON INTERIORS

Surfaces Painted— Woodwork, basement ceilings, incidental wood in industrial interiors
Uses— As a primer or as a finish coat
Formula— Pigment—2 pounds Standard Paste No. 205 (See pages 14 and 17)
Vehicle—1 gallon Long Oil Varnish (See page 86)
Thinner—1 pint Mineral Spirits
Yield— 1.29 gallons or approximately 1 gallon 2½ pints
Covering— 500 to 700 square feet per gallon (brushed)
500 to 700 square feet per gallon (sprayed)
Alternate Pigments—1¼ pounds Standard Lining No. 408 (See pages 15 and 20)
1½ pounds Standard Varnish No. 321 (See pages 14 and 20)
Alternate Vehicle†— Interior Varnish (See page 90)

WOOD TREATED WITH SOLUBLE STAINS

Surfaces Painted— Wood trim, doors, and furniture
Use— As a sealing coat to prevent bleeding of stains
Special Surface Treatment (Where necessary) Wash surface several times with coal tar naphtha and allow to dry 24 hours
Formula— Pigment—2½ pounds Standard Paste No. 205 (See pages 14 and 17)
Vehicle—1 gallon Interior Varnish (See page 90)
Thinner—½ pint Coal Tar Naphtha
Yield— 1.27 gallons or 1 gallon 2¼ pints

**Note:* These vehicles are necessary only where severe moisture conditions exist.

†*Note:* The Interior Varnish should not be thinned.

Exposure Tests of ALUMINUM PRIMING

Each of the eight test sections shown on the opposite page received two topcoats of white paint in addition to the priming coat.

1 — Sections of edge-grain Red Cedar after 4 years' exposure. Aluminum-primed lumber on left, white-primed lumber on right.

2 — Sections of White Pine after 4 years' exposure. Aluminum-primed lumber on left, white-primed lumber on right.

3 — Sections of flat-grain Redwood after 4 years' exposure. Aluminum-primed lumber on left, white-primed lumber on right.

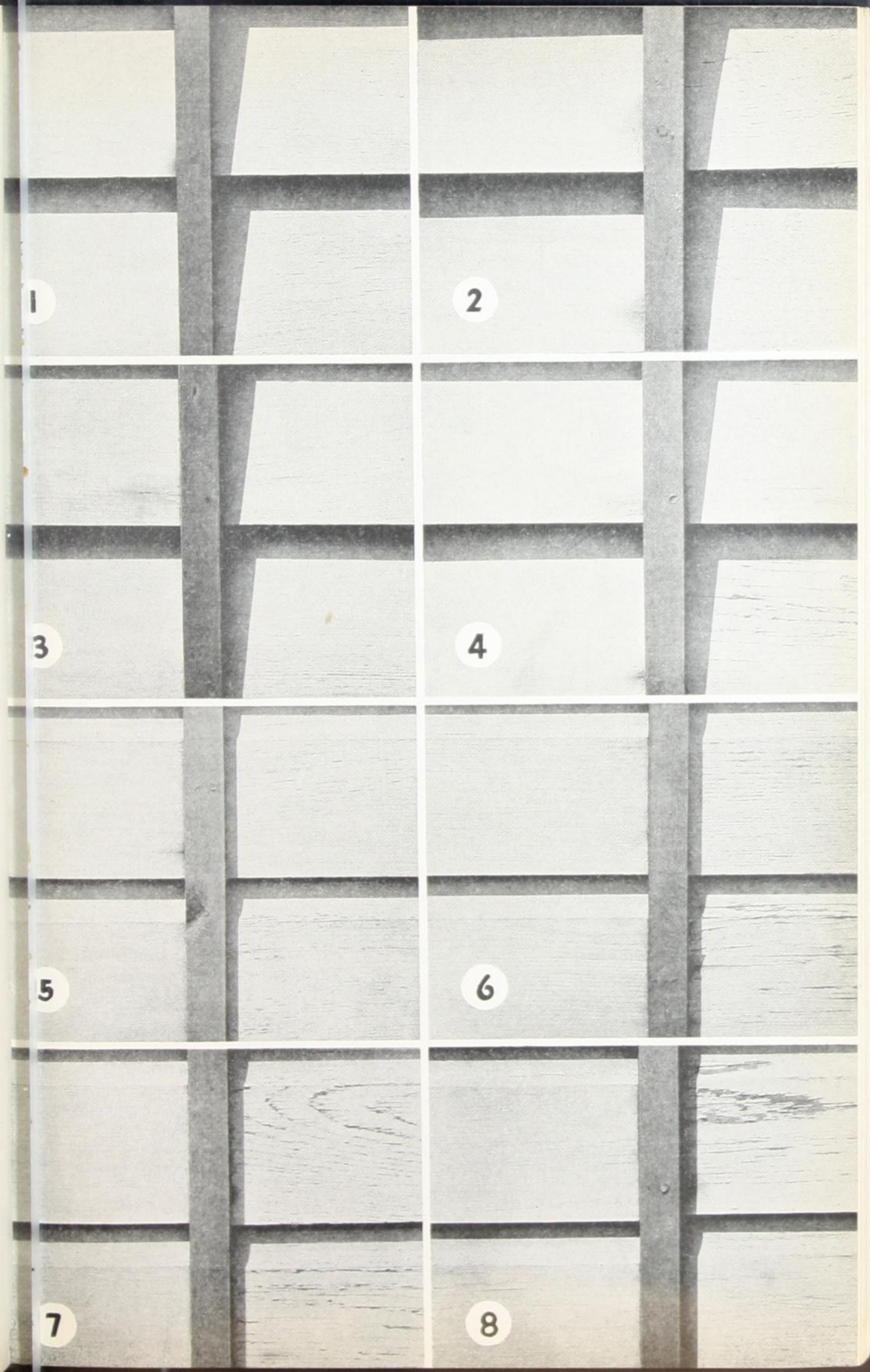
4 — Sections of Poplar siding after 4 years' exposure. Aluminum-primed lumber on left, white-primed lumber on right.

5 — Sections of Douglas Fir siding after 4 years' exposure. Aluminum-primed lumber on left, white-primed lumber on right.

6 — Sections of Engelmann Spruce after 4 years' exposure. Aluminum-primed lumber on left, white-primed lumber on right.

7 — Sections of Western Yellow Pine after 4 years' exposure. Aluminum-primed lumber on left, white-primed lumber on right.

8 — Sections of Southern Yellow Pine siding after 4 years' exposure. Aluminum-primed lumber on left, white-primed lumber on right.


1
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8

Covering— 600 square feet per gallon (brushed)
500 square feet per gallon (sprayed)
Alternate Pigment— 1¼ pounds Standard Lining No. 408 (See pages 15 and 20)
*Alternate Vehicle**— Gloss Oil Varnish (See page 25)

WOOD, PRESSURE CREOSOTED

Surfaces Painted— Guard rail posts, structural house and bridge timbers (*not* dipped shingles)
Uses— As first and finish coats
Special Surface Treatment— Weather surface for 3 to 6 months before painting
Formula— Pigment—3 pounds Standard Paste No. 205 (See pages 14 and 17)
Vehicle—1 gallon Interior Varnish (See page 90)
Yield— 1.246 gallons or approximately 1 gallon 2 pints
Covering— 450 to 500 square feet per gallon (brushed)
400 to 500 square feet per gallon (sprayed)
Alternate Pigment— 2½ pounds Standard Varnish No. 321 (See pages 14 and 20)
Alternate Vehicle— Gloss Oil Varnish (See page 25)

WOOD SUBMERGED IN WATER

Surfaces Painted— Inside and outside of boat hulls, floats, wet mining equipment, etc.
Uses— As a priming and a second coat
Special Treatment— Allow one week or more drying between coats
Formula— Pigment—2 pounds Standard Paste No. 205 (See pages 14 and 17)
Vehicle—1 gallon Phenolic Resin Base Varnish (See page 87)
Yield— 1.164 gallons or approximately 1 gallon 1¼ pints
Covering— 400 to 450 square feet per gallon (apply good heavy coat) (brushed)
400 to 450 square feet per gallon (apply good heavy coat) (sprayed)
Alternate Pigment— 2 pounds Standard Varnish No. 321 (See pages 14 and 20)
Alternate Vehicle†— Long Oil Varnish (See page 86)

**Note:* Do not thin Gloss Oil Varnish.
†*Note:* This vehicle should only be used where the phenolic resin base varnish is not available.

Aluminum Paint on Steel

Aluminum paint has become one of the most widely used protective coatings for steel because not only is it very durable, but also it is light in color, reflects light and heat, and has decorative value. It is usually employed as the intermediate and finishing coats over red lead or other good inhibitive pigment priming coats, but when properly applied to *clean*, rust-free steel, gives excellent service in two and three coats without the use of a priming paint. The importance of a clean surface on which paint is to be applied cannot be overemphasized in painting steel. If care is not taken in this work, much of the effort of the paint manufacturer to produce quality paints is wasted.

WEATHER-EXPOSED STEEL

Surfaces Painted—	Bridges, transmission towers, oil storage tanks, oil tank cars, water tanks, railroad signal towers, sheet metal roofs, ventilators, unheated stacks, corrugated siding, window sash and frames, metal buildings, fence posts, mine structures such as coal tipples, and similar applications
Uses—	As a second or intermediate coat and finish coats
Surface Treatment—	*Clean* and prime with red lead or other good rust inhibitive pigmented primer
*Intermediate Coat Formula**—	Pigments—1¾ pounds Standard Paste No. 205 (See pages 14 and 17) ¼ pound 50% Prussian Blue Paste (See page 31) Vehicle—1 gallon Glycerol-Phthalate Resin Base Varnish (See page 88)
Finish Coat Formula—	Pigment—2 pounds Standard Paste No. 205 (See pages 14 and 17) Vehicle—1 gallon Glycerol-Phthalate Resin Base Varnish (See page 88)

**Note:* The tinted intermediate coat may be purchased ready-mixed or mixed on the job as required. If mixed on the job, the paint should be allowed to stand three or four days before using to intensify the color contrast with the finish coat. This intermediate coat should always be brush applied, never sprayed.

Water tank spray-painted with aluminum paint.

Yield— 1.164 gallons or approximately 1 gallon 1¼ pints

Covering— 500 to 600 square feet per gallon (3–3½ tons) (brushed)
450 to 550 square feet per gallon (2½–3 tons) (sprayed)

Alternate Pigments— 2 pounds Standard Varnish No. 321 (See pages 14 and 20)
1½ pounds Standard Lining No. 408 (See pages 15 and 20)

Alternate Vehicles— Phenolic Resin Base Varnish (See page 87)
Long Oil Varnish (See page 86)

STEEL ON INTERIORS

Surfaces Painted— Structural trusses, supporting columns, cranes and crane runways, corrugated siding, tanks, water pipes, metal ducts, window sash and frames, stairs, railings, safety guards, ship interiors, underground mine equipment, and similar applications

Use— As finish coat

Surface Treatment— Clean and prime with red lead or other good rust inhibitive primer

Formula— Pigment—2 pounds Standard Paste No. 205 (See pages 14 and 17)
Vehicle—1 gallon Long Oil Varnish (See page 86)

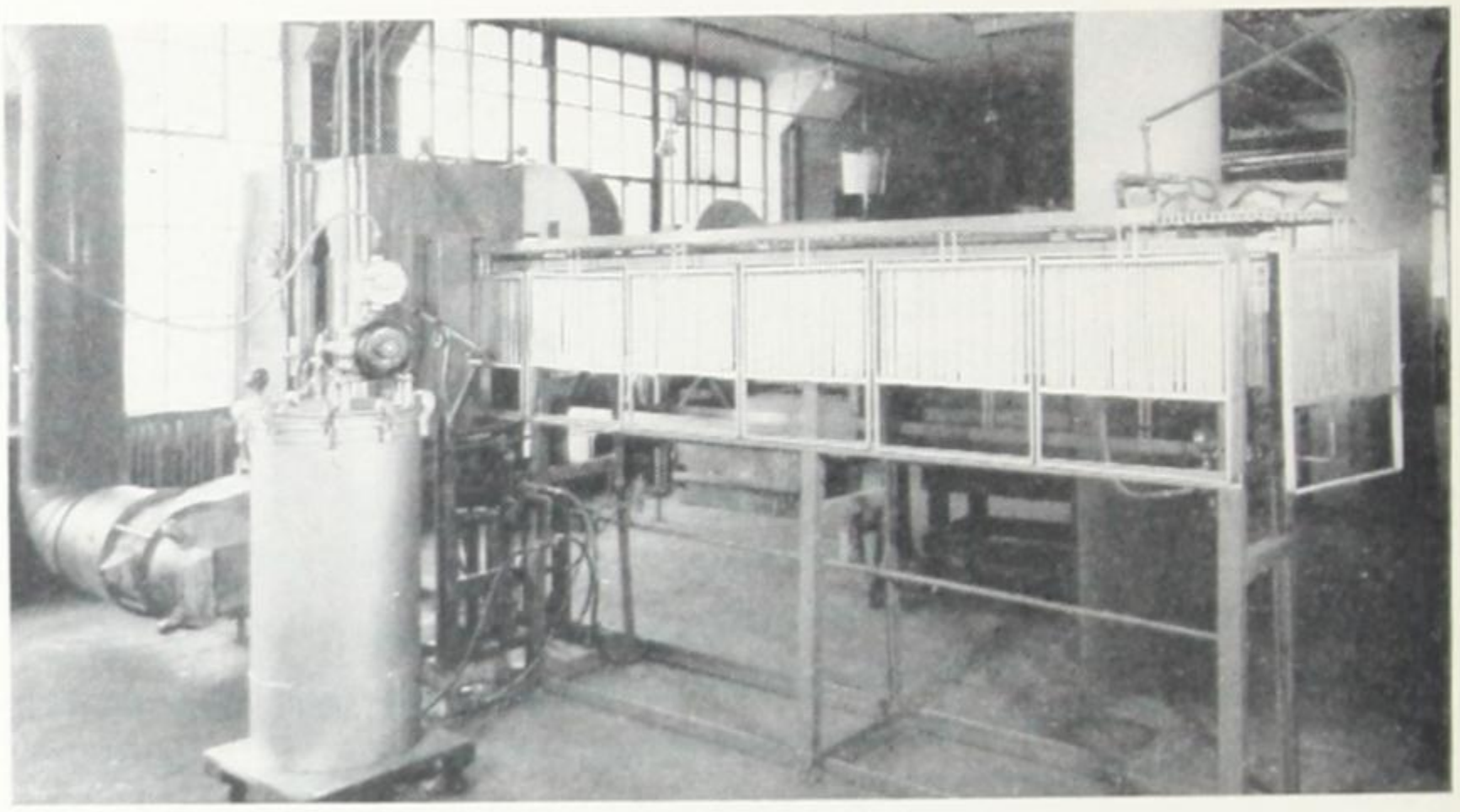
Yield— 1.164 gallons or approximately 1 gallon 1¼ pints

Covering— 600 to 700 square feet per gallon (brushed)
500 to 600 square feet per gallon (sprayed)

Alternate Pigments— 2 pounds Standard Varnish No. 321 (See pages 14 and 20)
1¼ pounds Standard Lining No. 408 (See pages 15 and 20)

Alternate Vehicles— Interior Varnish (See page 90)
Phenolic Resin Base Varnish (See page 87)

Note: The phenolic resin base varnish should be used where corrosive conditions or moisture conditions are unusually severe, such as in chemical plants, dyehouses, weaving rooms of textile plants, or in paper making and sugar refining factories. Steel in mines and other underground locations needs this type vehicle, as do the interiors of ships.



Automatic painting of hacksaw blades with a durable coat of aluminum.

STEEL PRODUCTS

Surfaces Painted—	Steel tank sheets, switchboard frames, fence posts, corrugated sheet, bedsprings, machinery, motor housings, castings, mail boxes, meter boxes, metal toys, license plates, signs, and similar applications
Use—	As finish coat
Surface Preparation—	All grease, rust, and dirt removed. No special primer used unless required by service to which article is put.
Spraying Formula—	Pigment—1¼ pounds Extra Fine Lining Paste No. 1571 (See pages 14 and 17) Vehicle—1 gallon Glycerol-Phthalate Resin Base Varnish (See page 88) Thinner—1 pint Coal Tar Solvent Naphtha
Yield—	1.22 gallons or 1 gallon 1¾ pints
Covering—	400 to 800 square feet per gallon (sprayed)
Alternate Pigments—	2 pounds Standard Paste No. 205 (See pages 14 and 17) 1½ pounds Standard Lining No. 408 (See pages 15 and 20) ¾ pounds Extra Fine Lining Powder No. 422 (See pages 15 and 20)
Alternate Vehicles—	Phenolic Resin Base Varnish (See page 87) Long Oil Varnish (See page 86) Nitrocellulose Lacquer (See page 92)

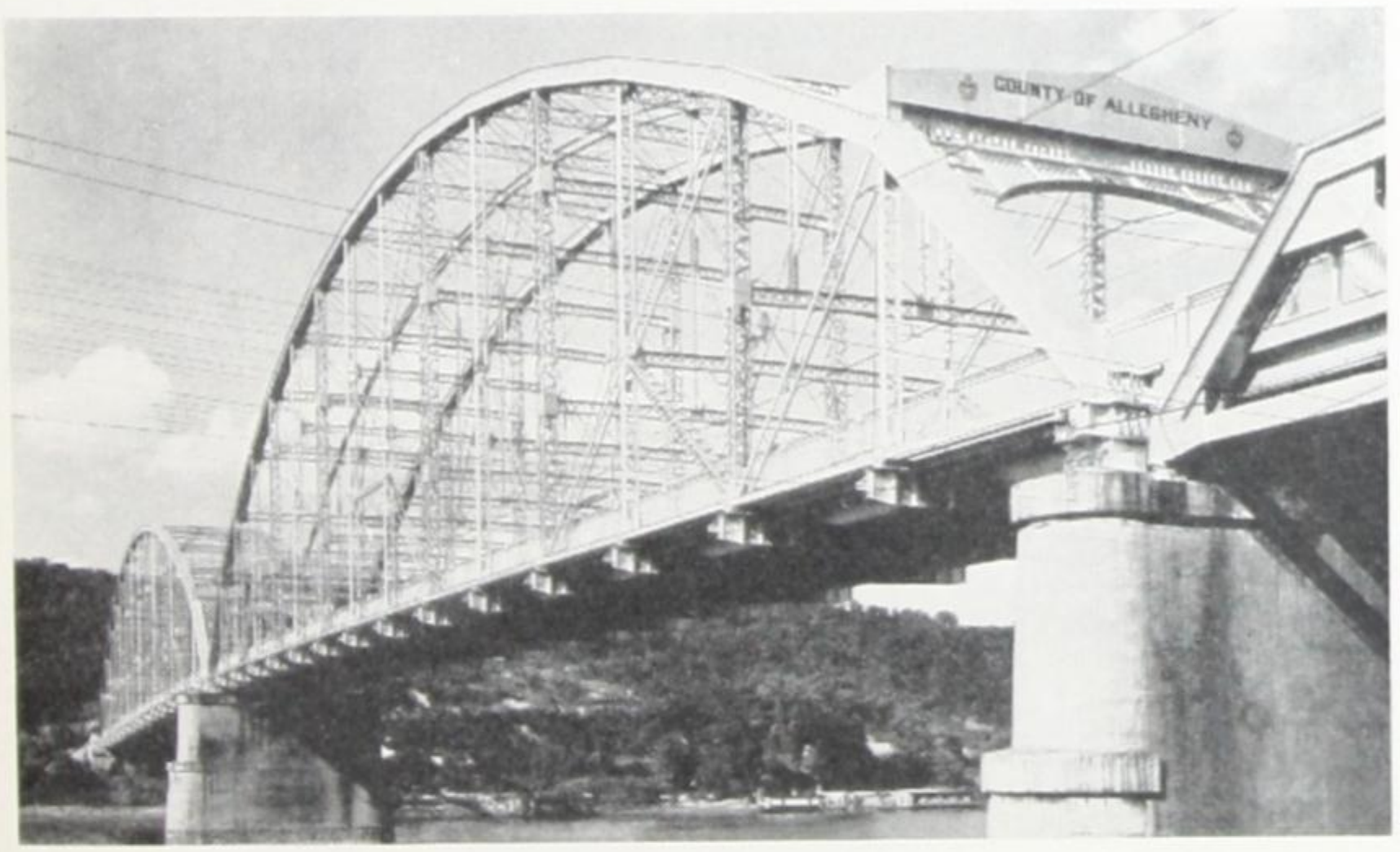
Dipping Formula— Pigment—1¼ pounds Extra Fine Lining Powder No. 422 (See pages 15 and 20)
Vehicle*—1 gallon special Glycerol-Phthalate Resin Base Varnish (See page 88)
Thinner—1 quart Coal Tar Solvent Naphtha

Yield— 1.31 gallons or approximately 1 gallon 2½ pints

Covering— 350 to 550 square feet per gallon (dipped)

Alternate Pigments—2 pounds Standard Paste No. 205 (See pages 14 and 17)
1½ pounds Extra Fine Lining Paste No. 1571 (See pages 14 and 17)
1½ Pounds Standard Lining Powder No. 408 (See pages 15 and 20)

*Alternate Vehicles**—Special Dipping Varnish (no reference)
Phenolic Resin Base Varnish (See page 87)



This is one of many bridges protected and beautified with aluminum paint.

**Note:* Dipping vehicles have to be selected on basis of leaf-retention properties and good flowing characteristics. They must be adjusted to each particular dipping problem.

Aluminum Paint on Galvanized Iron

There have been many successful applications of aluminum paint to galvanized iron surfaces. Aluminum paint works satisfactorily on galvanized iron without a primer if the surface has been exposed to active weathering for at least six months. Where such weathering is out of the question, chemical treatment of the zinc surface prior to painting has been found of value in promoting paint adhesion. Treatments with solutions of phosphoric acid or copper sulphate or copper acetate have been found helpful.

A number of special primers for new galvanizing have been developed that appear to have promise. They have not been in service, at this time, long enough to assure that perfect satisfaction can be obtained invariably. A good aluminum paint on *weathered* galvanizing may prove more satisfactory than some of these untried materials.

WEATHER-EXPOSED GALVANIZED IRON

Surfaces Painted—	Transmission towers, corrugated siding, gutters and downspouts, roofing and flashing, sheet metal ventilators, structural sections of billboards, billboard sheeting, and similar applications
Uses—	As primer and finish coats
Surface Preparation—	Weather not less than six months
Formula—	Pigment—2 pounds Standard Paste No. 205 (See pages 14 and 17) Vehicle—1 gallon Long Oil Varnish (See page 86)
Yield—	1.164 gallons or approximately 1 gallon 1¼ pints
Covering—	500 to 700 square feet per gallon (brushed only)
Alternate Pigments—	2 pounds Standard Varnish No. 321 (See pages 14 and 20) 1¼ pounds Standard Lining Powder No. 408 (See pages 15 and 20)
Alternate Vehicles—	Glycerol-Phthalate Resin Base Varnish (See page 88)

GALVANIZED IRON ON INTERIORS

Surfaces Painted—	Corrugated sheets, pipes, hot air ducts, furnace jackets, tanks, boxes, pails, and similar applications
Uses—	As primer and finish coats
Surface Preparation—	Wash with a solution of eight ounces of copper sulphate or copper acetate in warm water and allow to dry
Formula—	Pigment—2 pounds Standard Paste No. 205 (See pages 14 and 17) Vehicle—1 gallon Long Oil Varnish (See page 86)
Yield—	1.164 gallons or approximately 1 gallon 1¼ pints
Covering—	500 to 700 square feet per gallon (brushed only)
Alternate Pigments—	2 pounds Standard Varnish No. 321 (See pages 14 and 20) 1¼ pounds Standard Lining Powder No. 408 (See pages 15 and 20)
Alternate Vehicle—	Interior Varnish (See page 90)

Aluminum Paint on Tin Plate

Tin plate that is painted is used principally as a roofing material by tin smiths or in the fabrication of cans and boxes. In the case of roofing, tin plate must be protected or it will soon rust. Two coats of aluminum paint on such a roof protect the surface against rusting.

The decorating of tin plate containers is a specialized art and somewhat outside the scope of this manual. It is included here only as a matter of general interest. The special vehicles employed in this work must each be adapted to the particular type of machine on which they are used. The coverings and other data will vary with the kind of finish desired and the use to which the package may be put.

WEATHER-EXPOSED TIN PLATE

Surfaces Painted—	Roofs, flashing, piping, air ducts, and similar applications
Uses—	As primer and finish coats
Surface Preparation—	Wash off grease or dirt with mineral spirits or gasoline
Formula—	Pigment—2 pounds Standard Paste No. 205 (See pages 14 and 17) Vehicle—1 gallon Long Oil Varnish (See page 86)
Yield—	1.164 gallons or approximately 1 gallon 1¼ pints
Covering—	600 to 700 square feet per gallon (brushed) 500 to 600 square feet per gallon (sprayed)
Alternate Pigments—	2 pounds Standard Varnish No. 321 (See pages 14 and 20) 1¼ pounds Standard Lining Powder No. 408 (See pages 15 and 20)
Alternate Vehicle—	Very Long Oil Varnish (See page 91)

TIN LITHOGRAPHING

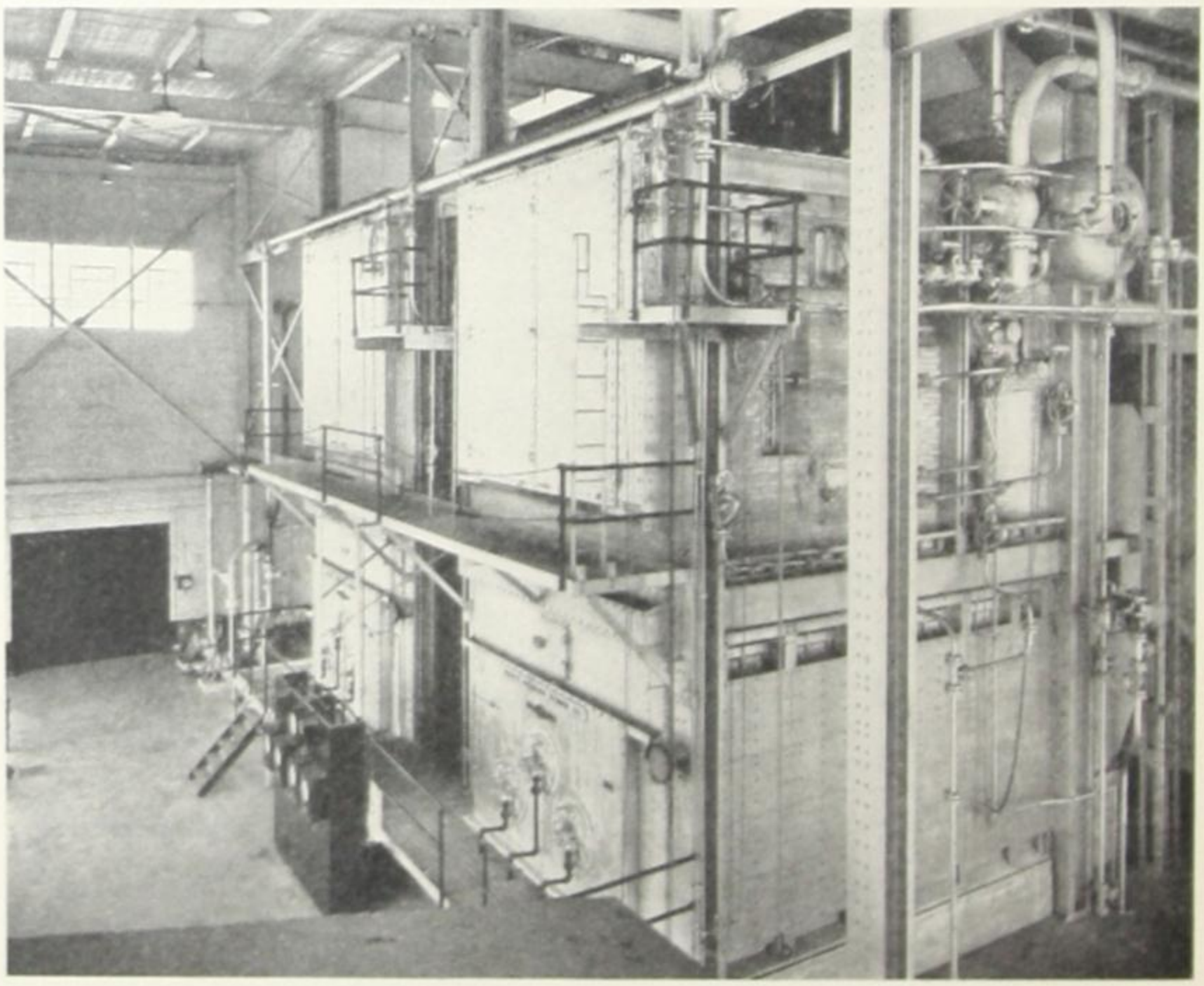
Surfaces Coated—	Metal cans, boxes, and toys
Use—	As base coat for other decorations
Formula—	Pigment—1½ pounds Extra Fine Lining Powder No. 422 (See pages 15 and 20)

	Vehicle*—1 gallon Special Synthetic Resin Varnish (See page 23) Thinner—1 quart special thinner
Yield—	1.32 gallons or approximately 1 gallon 2½ pints
Covering—	900 to 1200 square feet per gallon (roller coated)
Alternate Pigments—	2 pounds Extra Fine Lining Paste No. 1571 (See pages 14 and 17) 2 pounds Standard Lining Powder No. 408 (See pages 15 and 20)
*Alternate Vehicle**—	Ester Gum Varnish (no reference)

**Note:* This vehicle must be adjusted for correct operation on coating rolls by the addition of various lithographic linseed oils, varnishes, and driers to produce the vehicle that will give desired results on the tin plate. The coating is always baked.

Aluminum Paint on Heated Surfaces

There are available a number of aluminum paints that will withstand prolonged heating at temperatures around 1000°F. without changing color or losing their adhesion. None of these aluminum paints give satisfactory service on weather-exposed surfaces, since their heat resistance depends to a large extent on the absence of drying oils that give elasticity and durability to the other types of varnishes. The films must be thin for best results. When cold, such a film is quite brittle and is liable to crack if flexed to any great degree. Consequently, such liquids should not be used for painting stacks or stack breeching subject to the action of heating and cooling, rain, wind, and sunlight. Some vehicles, such as the glycerol-phthalate and phenolic



Furnaces operate with greater economy when the exteriors are aluminum painted.

types, give reasonably good results on heated stacks, but if these stacks are unlined and subject to temperatures above 600°F., the failure is quite marked. Because of its light color, aluminum paint on an unlined stack shows the areas that have flaked and peeled more than a dark-colored paint and the result is disfiguring and unsightly. On lined stacks and stacks operating at low temperatures, the color of aluminum paint is very pleasing and the countless stacks so painted attest to the popularity of the aluminum finish for this work. The suggestion is made that the breeching and lower ring of the stack be painted black, as these sections have the highest temperatures. The top ring should also be black, as this is the place where most of the discoloration from the smoke occurs. The middle sections painted with bright aluminum paint will be in attractive contrast to the black portions and because of the lower temperatures will have a surprisingly long life. Lined stacks may be painted with aluminum paint made with the regular varnish vehicles and there are records of such stacks where the aluminum paint is still in good condition after eleven years of service.

WEATHER-EXPOSED HEATED SURFACES

Note: This paint is not recommended on weather-exposed surfaces reaching temperatures in excess of 600°F.

Surfaces Painted—	Lined smokestacks, center sections of unlined smokestacks, and similar applications
Use—	As a finish coat *without a primer*
Surface Preparation—	Clean down to metal. Paint cold.
Formula—	Pigment—2½ pounds Standard Paste No. 205 (See pages 14 and 17) Vehicle—1 gallon Glycerol-Phthalate Resin Base Varnish (See page 88) Thinner—1 pint Coal Tar Solvent Naphtha
Yield—	1.33 gallons or approximately 1 gallon 2¾ pints
Covering—	600 to 800 square feet per gallon (brushed)
Alternate Pigment—	2 pounds Standard Varnish No. 321 (See pages 14 and 20)
Alternate Vehicle—	Phenolic Resin Base Varnish (See page 87)

HEATED SURFACES IN INTERIORS

Surfaces Painted—	Boilers, furnace fronts, steam pipes, gas and oil burners, and similar applications
Use—	As a finish coat *without a primer*
Surface Preparation—	Clean down to metal and roughen surface with coarse sandpaper if quite smooth. Paint cold.
Formula—	Pigment—2½ pounds Standard Paste No. 205 (See pages 14 and 17) Vehicle—1 gallon Heat-resisting Varnish (See page 91)
Alternate Pigment—	2½ pounds Standard Varnish No. 321 (See pages 14 and 20)

Aluminum Paint on Aluminum

The painting of aluminum follows the general technique used for the painting of other metals. When an aluminum paint or lacquer coating is to be employed solely for decoration, very little special preparation is needed. The surface must of course be clean and free from grease if satisfactory adhesion is to be obtained. Often a thorough cleaning with solvent is sufficient. When painting is done for protection, however, greater precautions must be taken just as in the case of other metals. Adequate preparation of the surface is quite important, as is the selection of a satisfactory primer.

The simplest, though least effective, form of surface preparation is solvent cleaning. This can be accomplished by washing with cloths saturated with solvent, or by actual immersion in the solvent, followed by wiping with clean cloths.

A number of chemical cleaners have appeared on the market during the past few years. There are two general types—mild alkaline cleaners of the sodium phosphate or sodium silicate type, and acid cleaners containing dilute solutions of phosphoric acid. The akaline cleaners appear to clean the surface of the aluminum without seriously attacking it and are fairly effective in securing good paint adherence. The phosphoric acid cleaners, which are usually dilute solutions of phosphoric acid in water and alcohol or other organic solvent, are much more effective. Apparently they form a thin layer of aluminum phosphate on the surface which is quite insoluble and which tends to protect the aluminum against corrosion. There are a variety of proprietary cleaners of this type available on the market.

Chemical oxide coatings are also finding increasing use as a base for paint. They are decidedly better than the use of the chemical cleaners mentioned above.

The best surface preparation for the painting of aluminum and its alloys is obtained by means of anodic coatings. Where the use of this method is practical, it is strongly recommended. The Alumilite* finishes and the chromic acid anodic coatings produce

*Patented process for producing oxide finishes.

corrosion-resistant, adherent, impervious oxide films which constitute ideal bases for paint. Their effectiveness depends on their passive and nonreactive qualities. They have found extensive use in the aircraft industry where the protection of thin sections is imperative. Impregnation of the coating with a dichromate solution is an added precaution against corrosion.

After cleaning or otherwise preparing the surface, the metal should be thoroughly dried by exposure to air or by heating, before paint can be applied. The metal should receive a minimum amount of handling after cleaning. The selection of the proper surface preparation from the foregoing methods is determined by the metal to be painted, the character of the structure, and the service conditions to which it will be exposed.

While it is not necessary to employ any special painting practice for applying decorative coatings to aluminum, a carefully selected painting system must be employed for protective coatings. The value of the system will depend to a large extent on the selection of the proper primer. The primer should have good resistance to moisture penetration to prevent surface reaction, should adhere well, form a good base for second coats, and in many cases should contain an inhibitive pigment.

Once the primer is properly applied, aluminum paint or almost any durable exterior paint or enamel may be employed for the finishing operation. Where the color of aluminum paint is satisfactory, it is especially recommended because of its properties of great opacity and high impermeability to moisture.

Bituminous paint (See page 24) may also be used for finishing aluminum, but, where they are used, a primer of the same material is recommended. If the black color of the bituminous paint is objectionable, it may be pigmented with aluminum paste or powder to give a very attractive finish.

Where extremely fast air-drying finishes are required, nitrocellulose lacquers may be employed. These may be secured in any desired color, including aluminum. The aluminum-pigmented lacquers are, perhaps, the most durable, since the tiny flakes of aluminum protect the nitrocellulose from the destructive action of sunlight. The most durable lacquers are those containing a certain

amount of synthetic resin (See page 23). In using a lacquer system, the primer must be carefully selected so that it will be entirely compatible with the lacquer finishing coats. The manufacturer of the lacquer is in a position to make recommendations for suitable primers.

The New York, New Haven, and Hartford "Comet" is a striking combination of blue and aluminum. The bands immediately above and below the windows are finished in clear lacquer over circular-brushed aluminum.

WEATHER-EXPOSED ALUMINUM

Surfaces Painted— Aircraft, busses, truck bodies, railway coaches, spandrels, window frames, or any aluminum surface that requires protection against severe corrosive conditions

Uses— As a primer and as a finish coat

Surface Treatment— Clean with solvent or special chemical solutions (See page 61). Prime with zinc chromate-iron oxide primer or aluminum paint.

Formula— Pigment—2 pounds Standard Paste No. 205 (See pages 14 and 17)
Vehicle—1 gallon Glycerol-Phthalate Resin Base Varnish (See page 88)

Yield— 1.164 gallons or approximately 1 gallon 1¼ pints

Covering— 600 to 700 square feet per gallon (brushed)
500 to 600 square feet per gallon (sprayed)

Alternate Pigments—1¼ pounds Standard Lining No. 408 (See pages 15 and 20)
¾ pound Extra Fine Lining No. 422 (See pages 15 and 20)
1¼ pounds Extra Fine Lining Paste No. 1571 (See pages 14 and 17)

Alternate Vehicles— Phenolic Resin Base Varnish (See page 87)
Long Oil Varnish (See page 86)
Nitrocellulose Lacquer (See page 92)

Note: With nitrocellulose lacquer the Extra Fine Lining pigments should be used and the quantities employed reduced by 50%.

Aluminum Paint on Brick

The painting of brick is usually for purposes of decoration, since protection of such a surface is unnecessary. It is believed that two coats of aluminum paint on exterior brick surfaces may prevent water seepage through the wall, but the effect is probably limited to sealing the mortar joints. On interiors with dark brick surfaces, aluminum paint finds one of its most useful functions,—that of reflecting light and improving lighting conditions in plants and industrial buildings. It also serves in the same capacity on the walls of dark courts in crowded metropolitan areas. Painting of brick surfaces is a relatively simple operation. Aluminum paint will hide any colored brick in one coat, either brush or spray applied.

WEATHER-EXPOSED BRICK

Surfaces Painted—	Walls of buildings, background for signs on brick walls, dark apartment courts, and similar applications
Uses—	As a primer and finish coat (2 coats needed)
Surface Preparation—	Dust off well and paint
Formula—	Pigment—2 pounds Standard Paste No. 205 (See pages 14 and 17) Vehicle—1 gallon Long Oil Varnish (See page 86)
Yield—	1.164 gallons or approximately 1 gallon 1¼ pints
Covering—	300 to 450 square feet per gallon (brushed) 400 to 450 square feet per gallon (sprayed)
Alternate Pigment—	2 pounds Standard Varnish No. 321 (See pages 14 and 20)

BRICK IN INTERIORS

Surfaces Painted—	Interior walls of factory buildings, garages, and similar applications
Use—	As a finish coat (1 coat needed)
Surface Preparation—	Clean well and paint
Formula—	Pigment—2 pounds Standard Paste No. 205 (See pages 14 and 17)

	Vehicle—1 gallon Interior Varnish (See page 90)
Yield—	1.164 gallons or approximately 1 gallon 1¼ pints
Covering—	300 to 450 square feet per gallon (brushed) 400 to 500 square feet per gallon (sprayed)
Alternate Pigment—	2 pounds Standard Varnish No. 321 (See pages 14 and 20)
*Alternate Vehicles**—	Phenolic Resin Base Varnish (See page 87) Long Oil Varnish (See page 86)

**Note:* These vehicles need not be used unless moisture and corrosive conditions are unusually severe.

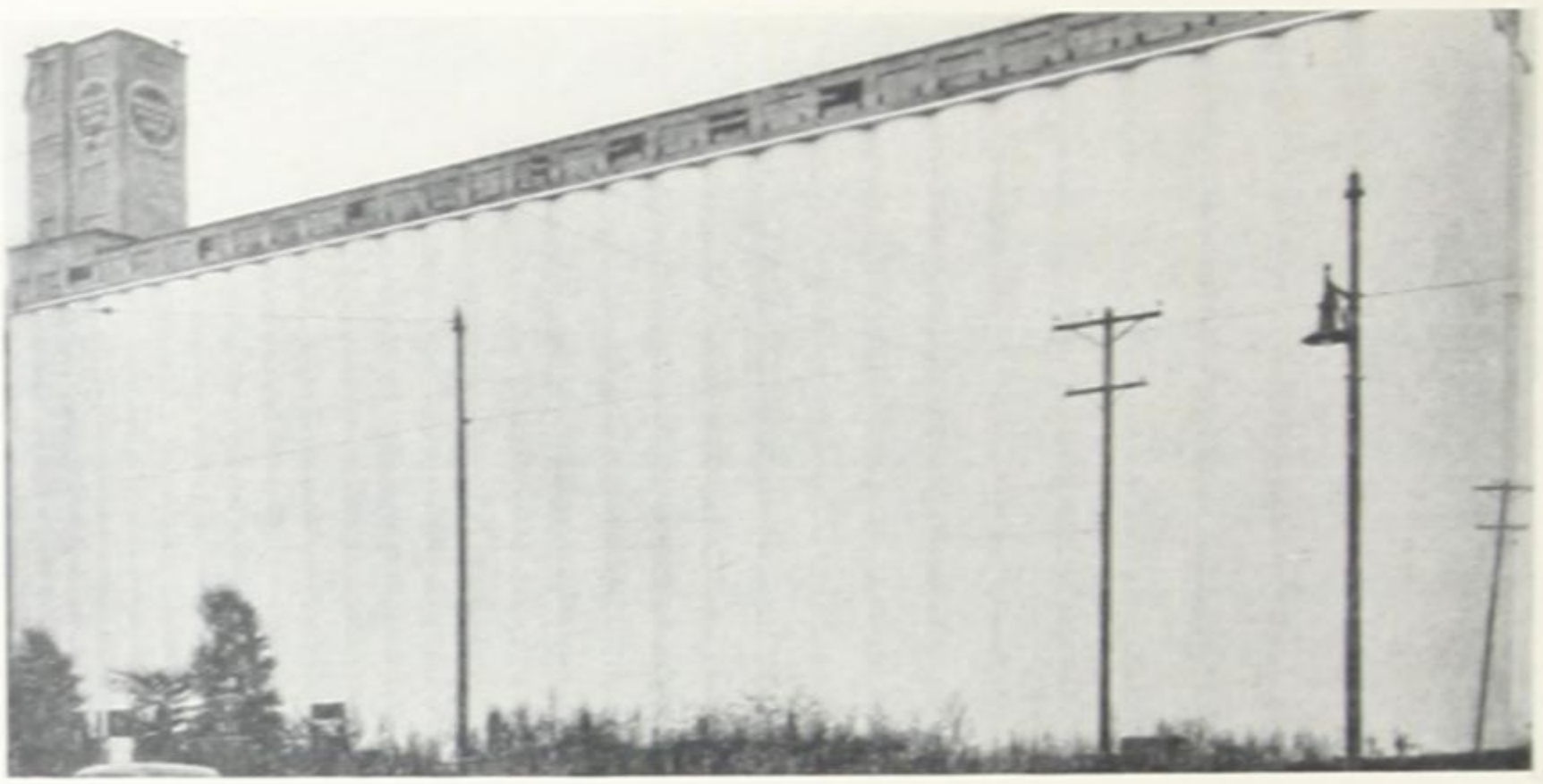
Aluminum Paint on Concrete

Destructive weathering of concrete has become a serious matter with maintenance engineers and many methods have been tried to prevent disintegration of surfaces of retaining walls, buildings, dams, and bridge piers. This deterioration is attributed in part to the action of water and frost, but much of it may be caused by the growth of crystals from mineral salt solution held in and beneath the cement surface. Aluminum paint has proved successful in greatly retarding or preventing this action of crystal growth by "waterproofing" the surface against rain and condensation.

Two types of treatment will be suggested. The experience with either type has not been extensive enough to determine which is the better. One involves the use of coal tar base coatings and the other the use of the Phenolic Resin Base Varnishes.

In the tar base type of treatment, the first step is to apply to the disintegrated concrete surface, after thorough scratch brushing, a liberal coating (at a rate of 200 square feet per gallon) of thinned down gas tar. This material is characterized by its high penetration properties and will soak into the porous surface and leave a nonperceptible film. In other words, the primer has been correctly applied when it dries to a flat finish free from glossy areas. This primer should be permitted to stand for about one week and then any glossy spots washed with solvent naphtha to remove the excess and again allowed to dry. Gloss can be avoided by care in application. Since the more weathered spots take up the primer rapidly, more should be applied at such places. But where the concrete is more or less protected by overhanging projections or, for some other reason, appears to have weathered less in spots, only a minimum of material should be applied in such areas.

After the primer has dried sufficiently, a coat of aluminum paint made with a tar base vehicle (See page 94) is then brushed or sprayed on. The powder leafs to form a brilliant aluminum paint, which hides the black undercoat completely. Since the primer is soluble in the topcoat, the two are intimately united



Many industrial exteriors like this grain elevator are protected with properly-made aluminum paint.

and the effect is a single coat of paint extending from the leafed surface to the concrete. Failure after years of exposure will come only by the slow weathering away of the coating and not by peeling and flaking. This is the principal advantage of the tar base system, coupled with the fact that such a coating may be applied to a damp wall when necessary without interfering seriously with the later efficiency of the coating. Its chief disadvantage is that on weathering the finish becomes darker and loses some of its aluminum color, more nearly resembling a dark gray to brown concrete surface, but still offering excellent protection against disintegration.

The other method takes advantage of the very high moisture and alkali resistance of Phenolic Resin Base Vehicles and their tendency to produce extremely hard weatherproof films. In this case the same vehicle is used for both primer and finishing coat. The primer is thinned slightly to encourage deep penetration and the topcoat is more heavily pigmented and is used without dilution, being applied as soon as the first coat has set up. Such a paint will retain a good color and elasticity over long periods of exposure. It will slowly weather thin without flaking, leaving a good surface for repainting. It must be applied only to thoroughly dried surfaces.

WEATHER-EXPOSED CONCRETE
(Two Systems)

Surfaces Painted— Retaining walls, dams, bridge piers, bridge members, building walls, tanks, and similar applications

Uses— (1) In the tar base system as finish coat and (2) in the varnish base system as primer and finish coat

(1) Tar Base System

Surface Preparation— Scratch brush to remove all loosely adhering material and apply a primer made of thinned down gas tar (See page 94)

Formula— (Finish coat) Pigment—2 pounds Standard Varnish No. 321 (See pages 14 and 20)
Vehicle—1 gallon Bituminous (Tar) Base Varnish (See page 94)

Yield— 1.1 gallons or approximately 1 gallon ¾ pint

Covering— 350 to 400 square feet per gallon (brushed)
400 to 450 square feet per gallon (sprayed)

(2) Varnish Base System

Surface Preparation— Scratch brush to remove all loosely adhering material

Formula— (Primer) Pigment—2 pounds Standard Paste No. 205 (See pages 14 and 17)
Vehicle—1 gallon Phenolic Resin Base Varnish (See page 87)
Thinner—1 quart Coal Tar Solvent Naphtha

Yield— 1.41 gallons or approximately 1 gallon 3¼ pints

Covering— 300 to 400 square feet per gallon (brushed)
350 to 450 square feet per gallon (sprayed)

Alternate Pigment— 2 pounds Standard Varnish No. 321 (See pages 14 and 20)

Formula— (Finish coat) Pigment—2 pounds Standard Paste No. 205 (See pages 14 and 17)
Vehicle—1 gallon Phenolic Resin Base Varnish (See page 87)

Covering— 450 to 500 square feet per gallon (brushed)
450 to 550 square feet per gallon (sprayed)

Alternate Pigment— 2 pounds Standard Varnish No. 321 (See pages 14 and 20)

CONCRETE IN INTERIORS

Surfaces Painted—	Walls and ceilings of buildings, basements, columns, and similar interior applications
Use—	As finish coat (1 coat required)
Surface Preparation—	Surface should be "aged" and dry, and cleaned to remove loose material
Formula—	Pigment—2 pounds Standard Paste No. 205 (See pages 14 and 17) Vehicle—1 gallon Interior Varnish (See page 90)
Yield—	1.164 gallons or approximately 1 gallon 1¼ pints
Covering—	350 to 450 square feet per gallon (brushed) 400 to 500 square feet per gallon (sprayed)
Alternate Pigments—	2 pounds Standard Varnish No. 321 (See pages 14 and 20) 1¼ pounds Standard Lining No. 408 (See pages 15 and 20)
*Alternate Vehicle**—	Long Oil Varnish (See page 86)

**Note:* This vehicle is recommended where concrete has recently been poured. It should be made from China wood oil and show good alkali resistance.

Aluminum Paint on Stucco

Painting stucco requires the same precaution as painting concrete,—namely, that the surface should have "aged" sufficiently to allow evaporation of moisture and conversion of lime and other alkaline substances to their more insoluble forms. This requires about four to six weeks or even longer if the atmospheric conditions are abnormal. Some authorities recommend washing the surface with a zinc sulphate solution on structures less than a year old. Aluminum paint serves as a priming coat to kill "hot spots" and to satisfy any porosity that may be present. On old weathered stucco, aluminum paint helps to fill hair-line cracks and checks and in most cases eliminates suction spots along the cracks, permitting the topcoats to dry to a uniform gloss, free from flat and mottled areas. Two topcoats of light-colored glossy paints are required to give satisfactory coverage, but one coat of darker colors, such as gray or buff, is usually sufficient.

Aluminum paint serves effectively as the topcoal on stucco.

WEATHER-EXPOSED STUCCO

Surfaces Painted—	Stucco houses, outdoor displays, walls, and similar applications
Use—	As a priming coat to seal the surface against moisture and suction of topcoats
Surface Preparation—	Be sure surface is clean of all loose material that will come off with scraper or light scratch brushing. New stucco should be allowed to age for not less than four weeks before applying paint.
Formula—	Pigment—2 pounds Standard Varnish No. 321 (See pages 14 and 20) Vehicle*—1 gallon Long Oil Varnish (See page 86)
Yield—	1.1 gallons or approximately 1 gallon ¾ pint
Covering—	300 to 350 square feet per gallon (brushed) 350 to 400 square feet per gallon (sprayed)
Alternate Pigment—	2 pounds Standard Paste No. 205 (See pages 14 and 17)
Alternate Vehicle—	Phenolic Resin Base Varnish (See page 87)

**Note:* The Long Oil Varnish should be alkali resistant and contain little or no linseed oil, the oil being mostly China wood oil.

Aluminum Paint on Plaster

It is difficult to give accurate general directions for painting plaster because such surfaces vary so widely in painting characteristics, depending on composition of plaster, accuracy of weighing and quality of mixing of the various ingredients, percentage of water used, and whether it was troweled on too wet or too dry. Aluminum paint made with the Long Oil Varnish vehicle (of *low acid* value and with a high China wood oil content) makes an excellent sizing coat for new plaster walls that have "aged" sufficiently. It is also used as a first coat in repainting old plaster walls that show bad hair-line cracks and suction spots. The aluminum pigment bridges over the cracks and fills them so that topcoats give a uniform appearance free from flat and glossy areas or lines.

Aluminum paint is used also as a finish coat on sand-finished plaster walls as a decorative light-colored coating. Its effectiveness is enhanced by the use of a brown or dark green stencil as a border. Smooth plaster walls on industrial interiors may be painted with a single coat and produce a satisfactory appearance, but such walls in offices and homes should be given a rather heavy coat of over-pigmented aluminum paint and the paint stippled with a stippling brush just before initial set takes place. If the paint is not stippled, the glossy brilliance of the coating will emphasize every trowel mark or patch and the effect will not be as pleasing. On sand-finished or rough plaster walls, stippling is unnecessary.

In general, the coarser grades of powder, such as Standard Varnish No. 321 or better yet, Extra Brilliant Varnish No. 301 (See pages 14, 17, and 20), should be used on smooth plaster walls that are to be stippled. These grades produce rougher finishes that are somewhat more light diffusing and aid in blocking out imperfections in the smooth walls. Two coats are usually required, as the first coat will show a difference in color on suction spots and along cracks. The first coat of course need not be stippled and need contain only about 75% of the pigment used in the finish coat.

SMOOTH PLASTER

Surfaces Painted—	Interior walls of kitchens, bathrooms, basements, theaters, night clubs, factories, offices, cafeterias, bakeries, store buildings, and industrial interiors
Uses—	1—As priming coat on new plaster walls or as undercoat on old painted walls or as a finish coat on industrial interiors 2—As finish coat (stippled) on residence, office, and theater walls, or wherever decorative effect warrants it
Surface Preparation—	On new walls, if not "aged," wash surface with salt or acid solutions such as *zinc sulphate or acetic acid* and allow to dry thoroughly (24 hours). On previously painted surfaces, clean well and remove all loose materials.
Formula No. 1— (Primer)	Pigment—1.5 pounds Standard Varnish No. 321 (See pages 14 and 20) Vehicle*—1 gallon Long Oil Varnish (See page 86)
Yield—	1.075 gallons or approximately 1 gallon ½ pint
Covering—	500 to 700 square feet per gallon (brushed) 500 to 600 square feet per gallon (sprayed)
Alternate Pigment—	1½ pounds Extra Brilliant Varnish No. 301 (See pages 14 and 17)
Alternate Vehicle—*	Interior Varnish (See page 90)
Formula No. 2— (Finish Coat)	Pigment—2¼ pounds Extra Brilliant Varnish No. 301 (See pages 14 and 17) Vehicle—1 gallon Long Oil Varnish (See page 86)
Yield—	1.13 gallons or approximately 1 gallon 1 pint
Covering—	400 to 450 square feet per gallon (brushed) 300 to 400 square feet per gallon (sprayed)
Alternate Pigment—	2¼ pounds Standard Varnish No. 321 (See pages 14 and 20)
Alternate Vehicle—	Interior Varnish (See page 90)

**Note:* The Long Oil Varnish should be alkali resistant and high in China wood oil content if used on new plaster walls. On old painted walls, the Interior Varnish may be safely used.

ROUGH OR SAND-FINISHED PLASTER

Surfaces Painted—	Living room walls, billiard and card room club walls, recreation basement rooms, residence garages, and similar applications
Uses—	As primer and finish coat or as one-coat application
Surface Preparation—	Dust well, clean, and paint
Formula—	Pigment—2 pounds Standard Paste No. 205 (See pages 14 and 17) Vehicle—1 gallon Interior Varnish (See page 90)
Yield—	1.164 gallons or approximately 1 gallon 1¼ pints
Covering—	400 to 500 square feet per gallon (brushed) 400 to 500 square feet per gallon (sprayed)
Alternate Pigment—	2 pounds Standard Varnish No. 321 (See pages 14 and 20)
Alternate Vehicle—	Long Oil Varnish* (See page 86)

**Note:* Long Oil Varnish should be used on new plaster walls and should be high in China wood oil content.

Aluminum Paint on Gypsum and Wallboard

Wallboard, gypsum, or plasterboard are often difficult to paint because of their high absorption characteristics. Aluminum paint on such surfaces will dry to a flat finish and may show some rubbing of pigment unless the surface is first sized with the clear varnish. Two coats of aluminum paint may be required to give a uniform, brilliant surface, free from flat areas. If the board is used on the interior of homes or restaurants, it is well to stipple the last coat to produce a more pleasing effect (see painting plaster on pages 73 to 75). The pigment may be either paste or powder, depending on whether a smooth, brilliant surface is desired, or a rough-textured one. If the paint is used as a decorative coating, the covering strips should be painted in some contrasting color, such as brown or dark green. A dark-colored stenciled border is also pleasing.

WALLBOARD

Surfaces Painted—	Attic walls, recreation rooms, temporary office walls, roof slabs, and similar applications
Uses—	As finish coats
Surface Preparation—	If not previously painted, size with clear varnish vehicle and allow to dry 24 hours before applying topcoats
Formula—	Pigment—2 pounds Standard Paste No. 205 (See pages 14 and 17) Vehicle—1 gallon Interior Varnish (See page 90)
Yield—	1.164 gallons or approximately 1 gallon 1¼ pints
Covering—	450 to 550 square feet per gallon (brushed) 400 to 500 square feet per gallon (sprayed)
Alternate Pigment—	2 pounds Standard Varnish No. 321 (See pages 14 and 20)
Alternate Vehicle—	Long Oil Varnish (See page 86)

Note: Best results are obtained if vehicles used are rather heavy bodied to prevent deep penetration.

Aluminum Paint on Composition Roofing

Roofing surfaces of this type are subject to deterioration because of the constant attack of sunlight and moisture. It has been found that the life of such roofing may be greatly extended by the use of aluminum paint, particularly those made with Bituminous Varnish Vehicles (See page 24). Not only does such a coating protect the roofing material, but it also seals up small leaks that may have developed. Of equal importance is the fact that by presenting a light reflecting surface of brilliantly leafed aluminum flakes, a substantial amount of heat is reflected. No figures can be given on the effectiveness of aluminum paint in reducing interior temperatures because this will vary with the

Aluminum paint on this roof serves to keep interior temperatures lower.

heat insulating characteristics of the roof itself, but the temperature difference between a black surface and an aluminum painted surface on a warm summer day may be as much as 10 to 40°F. depending upon conditions.

COMPOSITION ROOFING

Surfaces Painted—	Roofs of industrial buildings, barns, homes, garages, and similar applications
Use—	As a finish coat
Surface Preparation—	Clean well and paint
Formula—	Pigment—2 pounds Standard Paste No. 205 (See pages 14 and 17) Vehicle—1 gallon Bituminous Base Varnish (See page 93)
Yield—	1.164 gallons or approximately 1 gallon 1¼ pints
Covering—	500 to 700 square feet per gallon (brushed) 500 to 600 square feet per gallon (sprayed)
*Alternate Pigment**—	2 pounds Standard Varnish No. 321 (See pages 14 and 20)
Alternate Vehicle—	Long Oil Varnish (See page 86)

**Note:* If tar base vehicle is used, the powder pigment must be employed, as paste is not compatible with this type of liquid. If asphalt base vehicle is used, either paste or powder may be employed.

Aluminum Paint on Asphalt and Tar Surfaces

Surfaces coated with a heavy application of asphalt or tar cannot be painted with oil paints of light color without the danger of bad bleeding and discoloration. Aluminum paint, because of its leafed surface, may be used either as a finish coat or as an undercoat on such surfaces with very good results. It effectively stops bleeding in practically all cases and light-colored topcoats may be applied over the aluminum undercoat without the discoloring stains coming through. On new applications of asphalt or tar, it is well to have them weathered or oxidized for a short time and to harden thoroughly before applying the aluminum paint when oil paint will be used later. Painting may proceed at once if aluminum is the final color.

On weather-exposed surfaces, aluminum paint protects these black surfaces against sunlight deterioration and adds years of life to the coating. On interiors, its chief purpose is to provide a light-colored surface in place of the less pleasing black color of these materials.

WEATHER-EXPOSED ASPHALT AND TAR SURFACES

Surfaces Painted—	Roofs, tanks, concrete, bridge piers, swimming pools, walls of buildings, submerged surfaces, dam gates, and similar applications
Uses—	As finish coat or as undercoat for light-colored oil paints
Surface Preparation—	Clean well and paint
Formula—	Pigment—2 pounds Standard Paste No. 205 (See pages 14 and 17) Vehicle—1 gallon Long Oil Varnish (See page 86)
Yield—	1.164 gallons or approximately 1 gallon 1¼ pints
Covering—	500 to 600 square feet per gallon (brushed) 450 to 550 square feet per gallon (sprayed)
Alternate Pigment—	2 pounds Standard Varnish No. 321 (See pages 14 and 20)

*Alternate Vehicle**— Bituminous Base Varnish (See page 93)

INTERIOR ASPHALT AND TAR SURFACES

Surfaces Painted—	Walls of refrigerator rooms, waterproofed concrete, and similar applications
Uses—	As finish coat and as undercoat for light-colored oil paints
Surface Preparation—	Clean well and paint
Formula—	Pigment—2 pounds Standard Paste No. 205 (See pages 14 and 17) Vehicle—1 gallon Interior Varnish (See page 90)
Yield—	1.164 gallons or approximately 1 gallon 1¼ pints
Covering—	500 to 600 square feet per gallon (brushed) 500 to 600 square feet per gallon (sprayed)
Alternate Pigment—	2 pounds Standard Varnish No. 321 (See pages 14 and 20)

**Note:* Light-colored paints should not be used over aluminum paint made with Bituminous Base Varnish Vehicles.

Aluminum Paint on Canvas

Because of the high protective value of aluminum paint, canvas coverings on truck roofs, decks of ships, awnings, tarpaulins, and other weather-exposed surfaces make use of this coating extensively. It retards rotting of the fabric and aids in waterproofing, and has the advantage of reflecting light and heat.

The loose covering on a truck whips and stretches in the wind and is exposed to sunlight and weather all through the year. The coverings on bus tops and ship decks must resist the abrasion of walking and dragging of heavy objects over them. Awnings and tarpaulins must not stick when rolled or folded. All these requirements point to the use of the most elastic and hardest drying vehicle available,—the phenolic resin base varnish.

WEATHER-EXPOSED CANVAS

Surfaces Painted—	Truck covers, decks of ships, tops of busses, trucks and trailers, awnings, tarpaulins, and similar applications
Uses—	As primer and finish coat
Surface Preparation—	Clean well and paint
Formula—	Pigment—2 pounds Standard Paste No. 205 (See pages 14 and 17) Vehicle—1 gallon Phenolic Resin Base Varnish (See page 87)
Yield—	1.164 gallons or approximately 1 gallon 1¼ pints
Covering—	250 to 300 square feet per gallon (brushed) 1st coat 500 to 600 square feet per gallon (brushed) 2nd coat
Alternate Pigments—	2 pounds Standard Varnish No. 321 (See pages 14 and 20) 1¼ pounds Standard Lining No. 408 (See pages 15 and 20)
Alternate Vehicle—	Long Oil Varnish (See page 86)

Note: Canvas coatings should be brushed, not sprayed, as brushing lays the nap and fills the surface better. A sprayed or brushed application of solvent may help penetration of first coat by displacing air in the fabric.

General Interior Painting with Aluminum Paint

It often happens that interiors of factory buildings, basements, garages, etc., will be made up of a number of different types and kinds of surfaces. For example, an industrial plant will have brick walls, concrete supporting posts, steel roof trusses, wood ceilings, and asphalt coated pipes and tanks. All such paintable surfaces are specifically covered in this manual with detailed directions as to the selection of the right vehicle and pigment. In many cases it is not desirable or convenient to make up special mixtures for each type of surface, particularly if no serious exposure conditions will be encountered. In such cases one kind of aluminum paint may usually be selected to do the entire job. For this reason, general recommendations covering the painting of such interiors are given herewith in the same manner as if the whole interior were a single specific surface and not a combination of surfaces as it most often is.

In connection with the painting of interiors, some further suggestions may be helpful. For example, a dark green dado line four or five feet high will protect the light-colored aluminum paint from being soiled by finger marks or scrub water. It also increases the apparent brightness of the job and furnishes a pleasing color contrast that is restful to the eye. Brushed aluminum paint jobs made with paste are more brilliant, but give less light diffusion than when the same paint is sprayed. Therefore, spraying is recommended where an increase in lighting efficiency is desired. Rough places in concrete ceilings often appear poorly covered from the floor, though close examination proves that there is a good coating. Such places, if small in number, may be filled with a heavy paste made of "whiting" and oil and then sprayed over again to produce a uniform appearance.

Electrical insulation or open light wires and sockets should not be sprayed with aluminum paint as it is likely to short circuit the current. Either mask such places or paint around them with a brush. Be sure all machinery or other equipment is well

covered when spraying aluminum paint. It is so light it flies long distances and may spot machines that are at the other end of a long building.

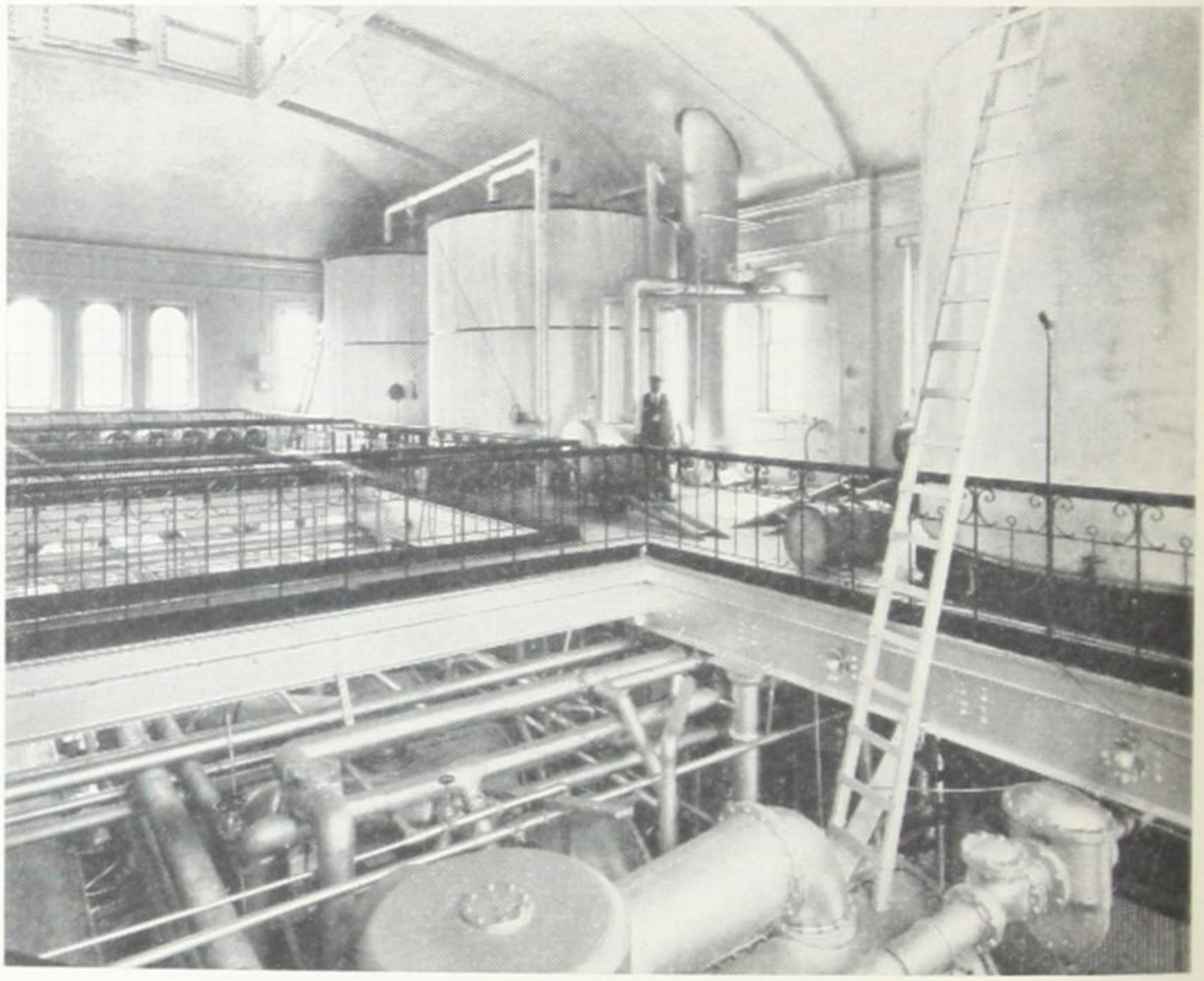
Aluminum pigments are nonpoisonous, but the solvents used in the vehicles are often irritating to the skin and lungs of some workmen. Provide masks and respirators for spray gun operators and insist that they be used in order to avoid compensation claims. Have workmen grease their faces with cold cream or petrolatum to avoid skin irritations from these solvents. Be sure adequate ventilation is supplied at all times and particularly when working near the roof of a high building or in enclosed spaces.

INTERIOR SURFACES—NORMAL EXPOSURE

Type of Application—	Machine shops, garages, warehouses, metal fabricating plants, foundries, printing rooms, basements, and similar buildings
Use—	As finish coat
Surface Preparation—	Remove all loose material, wash greasy area with gasoline, dust well, apply inhibitive priming coat (such as red lead) to all steel surfaces, or spot prime as necessary
Formula—	Pigment—2 pounds Standard Paste No. 205 (See pages 14 and 17) Vehicle—1 gallon Interior Varnish (See page 90)
Yield—	1.164 gallons or approximately 1 gallon 1¼ pints
Covering—	450 to 600 square feet per gallon (brushed) 450 to 500 square feet per gallon (sprayed)

INTERIOR SURFACES—EXPOSED TO MOISTURE AND FUMES

Type of Application—	Breweries, dairies, laundries, ice plants, ice cream plants, paper mills, textile mills, meat packing plants, and similar buildings
Use—	As finish coat
Surface Preparation—	Remove all loose material. If necessary wash walls with water to remove soluble deposits. Wash greasy areas with gasoline. Apply inhibitive priming coat (such as red lead) to all steel surfaces after thorough cleaning to remove all rust and loose paint.



Aluminum paint not only brightens interiors, but gives them a clean appearance as well.

Formula— Pigment—2 pounds Standard Paste No. 205 (See pages 14 and 17)
Vehicle—1 gallon Long Oil Varnish (See page 86)

Yield— 1.164 gallons or approximately 1 gallon 1¼ pints

Covering— 450 to 600 square feet per gallon (brushed)
450 to 500 square feet per gallon (sprayed)

INTERIOR SURFACES—CORROSIVE ATMOSPHERE

Type of Application— Chemical manufacturing plants, sulphuric acid plants, pickling rooms, battery manufacturing plants, oil refineries, food plants, dyehouses, sugar refineries, window glass plants, or wherever acid fumes or similar corrosive gases are produced in concentrated form. (Note: Aluminum paint is not rec-

ommended for protection against strongly alkaline spray or fume.)

Uses— As first and second finish coats

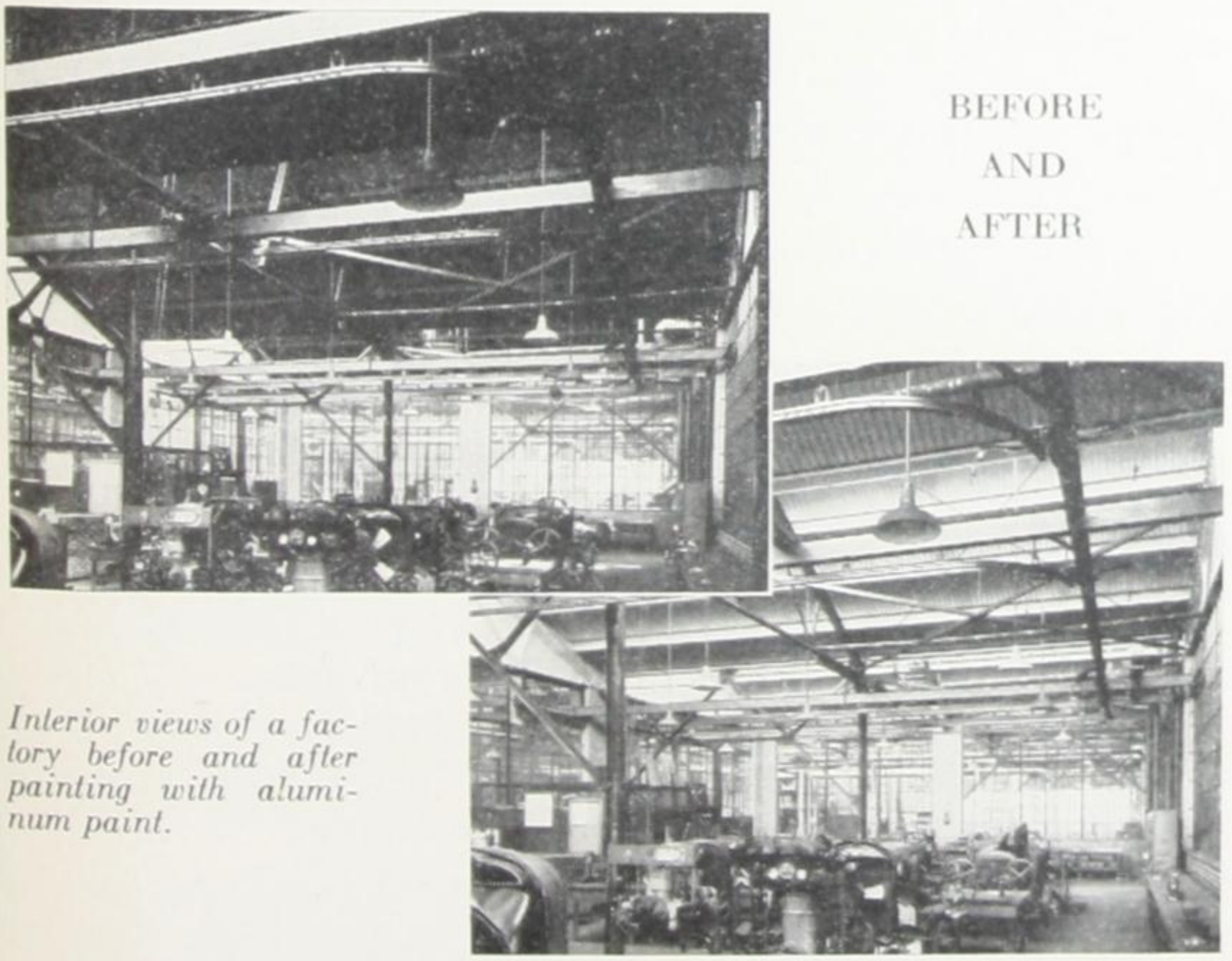
Surface Preparation— Wash surface thoroughly with clear water and wipe dry to remove soluble materials. Prime all steel with good coat of inhibitive primer (such as red lead in synthetic vehicle). Clean as completely as possible, because if surface is not well prepared, the paint will fail very quickly.

Formula— Pigment—2½ pounds Standard Paste No. 205 (See pages 14 and 17)
Vehicle—1 gallon Phenolic Resin Base Varnish (See page 87)

Yield— 1.20 gallons or approximately 1 gallon 1¾ pints

Covering— Apply so as to cover *not more than 400 square feet per gallon*; either spray or brush

Note: Thick films uniformly applied are necessary to obtain good protection under severe conditions. Two coats of aluminum paint should be used in such cases and the first coat tinted to give color contrast (See page 31).



Interior views of a factory before and after painting with aluminum paint.

SPECIFICATIONS FOR ALUMINUM PAINT VEHICLES

These specifications represent the minimum requirements for a good aluminum paint vehicle and will give generally satisfactory results. Many quality vehicles exceed these minimum requirements and afford sufficient extra protection and value to justify their higher cost.

12. ***Vehicle—Long Oil Varnish:*** The vehicle for use on weather-exposed steel or other metals, brick, concrete, and plaster, shall consist of a long oil varnish, made from ester gum, cumarone-indene, Amberol B1 or F7 or other suitable resins, together with suitable drying oils, and shall fulfill the following requirements:

a. The varnish shall be clear and transparent.

b. The viscosity shall be between 0.50 and 1.0 poise at 25° C. (77° F.), corresponding to Tubes A to D of the Gardner-Holdt Air Bubble Viscometer, if it is to be used with Alcoa Albron Powder, or between 0.65 and 1.25 poises at 25° C. (77° F.), corresponding to Tubes B to E, if it is to be used with Alcoa Albron Paste.

c. The acid number of the vehicle shall be less than 15, based on nonvolatile content of the varnish.

d. It shall contain not less than 50% by weight of nonvolatile oils and gums.

e. It shall pass a 60% Kauri Reduction Test as described in Federal Specification TT-V-81, Paragraph F-2g.

f. When thoroughly mixed with Alcoa Albron Paste or Powder in the proportion of 2 pounds per gallon of vehicle, the paint shall have good leafing quality, show satisfactory brushing and leveling properties, and shall not break or sag when applied to a vertical, smooth, steel surface.

g. The *paint* shall set to touch in not less than 1 hour nor more than 6 hours and dry hard and tough in not more than

24 hours at a temperature of 20° C. (68° F.) to 30° C. (86° F.), except where it is to be used on brick, concrete, or plaster, in which case the *paint* shall set to touch in 1 to 3 hours and dry hard and tough in not more than 18 hours at the same temperature.

13. Vehicle—Phenolic Resin Base Varnish: This specification is designed to cover a long oil phenolic resin varnish of maximum elasticity and durability for use in making aluminum paint for all exterior applications.

a. The oil shall be vegetable drying oil as is necessary to meet the specification requirements. The volatile thinner shall be free from toxic hydrocarbons such as benzol. The varnish shall be free from rosin or rosin derivatives, as determined by the Liebermann-Storch Test.

b. It shall be clear and transparent.

c. The viscosity shall be between 0.50 and 1.0 poise at 25° C. (77° F.), corresponding to Tubes A to D of the Gardner-Holdt Air Bubble Viscometer, if it is to be used with Alcoa Albron Powder, or between 0.65 and 1.25 poises at 25° C. (77° F.), corresponding to Tubes B to E if it is to be used with Alcoa Albron Paste.

d. The flash point shall not be below 30° C. (86° F.) in a closed cup tester.

e. The varnish shall contain not less than 50% by weight of nonvolatile oils and resin.

f. It shall pass a 140% Kauri Reduction Test, using the method described in Federal Specification TT-V-81, Paragraph F-2g.

g. It shall show no skinning after 48 hours in a three-quarters filled, tightly closed container.

h. It shall pass the gas and draft tests as described in U. S. Navy Specification 52V-14a.

i. Flow-out films on 28 gauge tin plate panels dried 72 hours shall withstand immersion in cold water for 96 hours and hot water (75° C. or 167° F.) for 6 hours without whitening, dulling, checking, or showing other serious defect.

j. Films applied to test tubes (dimensions 6″ x 1″) by immersion in varnish to a depth of 4 inches and dried in an inverted position for 72 hours shall show no whitening, dulling, or visible attack when immersed to a depth of 2 inches in a 5% solution of sodium hydroxide for six hours (at 20° C. or 68° F.) and (a separate similar film) a 4% solution of acetic acid for 24 hours (at 20° C. or 68° F.).

k. A flow-out film on 28 gauge tin plate, air-dried 48 hours, shall be immersed in straight run gasoline 48 hours. After subsequent air-drying for 2 hours the film shall show no whitening, dulling, or visible attack.

l. When thoroughly mixed with Alcoa Albron Paste or Powder in the proportion of 2 pounds per gallon of vehicle, the paint shall have good leafing quality, show satisfactory brushing and leveling properties, and shall not break or sag when applied to a vertical, smooth, steel surface.

m. Aluminum paint made with this varnish, when applied to a metal panel and allowed to dry in a vertical position, shall set to touch in not less than 1 hour nor more than 3 hours and dry hard and tough in not more than 18 hours at a temperature of 20° C. (68° F.) to 30° C. (86° F.).

14. Vehicle—Glycerol-Phthalate Resin Base Varnish: This specification is designed to cover a glycerol-phthalate (alkyd) resin varnish of maximum elasticity and durability for use in making aluminum paint for all exterior applications.

a. The varnish shall be of glycerol-phthalate type containing not less than 35% glycerol-phthalate (based on solids content) determined by the method described in Tentative U. S. Navy Specification ST-15b and shall be free from rosin or rosin derivatives as determined by the Liebermann-Storch Test.

b. It shall be clear and transparent.

c. The viscosity shall be between 0.50 and 1.0 poise at 25° C. (77° F.), corresponding to Tubes A to D of the Gardner-Holdt Air Bubble Viscometer, if it is to be used with Alcoa Albron Powder, or between 0.65 and 1.25 poises at 25° C. (77° F.), corresponding to Tubes B to E if it is to be used with Alcoa Albron Paste.

d. The flash point shall not be below 30° C. (86° F.) in a closed cup tester.

e. The varnish shall contain not less than 48% by weight of nonvolatile matter.

f. The acid number of the vehicle shall be less than 8.

g. A flow-out film of the varnish on 28 gauge tin plate, air-dried 18 hours, and then baked at 82° C. (179.6° F.) to 85° C. (185° F.) for 2 hours shall show no cracking of the film when suddenly chilled to 0° C. (32° F.) and quickly bent sharply on itself. The bent part of the baked panel shall show satisfactory adhesion under a knife test.

h. A flow-out film of the varnish on colorless glass, air-dried 18 hours, then baked for not less than 2 hours, at 82° C. (179.6° F.) to 85° C. (185° F.) shall be hard, tough, smooth, transparent, and free from all defects such as checking, dulling, or wrinkling, when compared to a fresh film.

i. It shall show no skinning after one week in a half-filled, tightly closed glass container stored in a dark place.

j. A flow-out film on 28 gauge tin plate, air-dried for 48 hours, shall withstand immersion in cold water for 18 hours without whitening and shall show only slight dulling. After removal from the water for 2 hours the original gloss and hardness shall return.

k. A flow-out film on 28 gauge tin plate, air-dried 48 hours, shall retain its gloss and general appearance after 24 hours' immersion in straight run gasoline. After air-drying 4 hours,

the film shall have regained its initial hardness and toughness. There shall be no dissolution effect on the lower immersed edge.

l. When thoroughly mixed with Alcoa Albron Paste or Powder in the proportion of 2 pounds per gallon of vehicle, the paint shall have good leafing quality, show satisfactory brushing and leveling properties, and shall not break or sag, when applied to a vertical, smooth, steel surface.

m. Aluminum paint made with this varnish, when applied to a metal panel and allowed to dry in a vertical position, shall set to touch in not less than 1 hour nor more than 4 hours and dry hard and firm in not more than 16 hours at a temperature of 20° C. (68° F.) to 30° C. (86° F.).

15. Vehicle—Interior Varnish: The vehicle for general use on steel or other metals, brick, concrete, or plaster, subject to interior exposure, shall consist of a varnish fulfilling the following requirements:

a. The varnish shall be clear and transparent.

b. The viscosity shall be between 0.50 and 1.0 poise at 25° C. (77° F.), corresponding to Tubes A to D of the Gardner-Holdt Air Bubble Viscometer.

c. It shall contain not less than 45% by weight of non-volatile oils and gums.

d. It shall pass a 0% Kauri Reduction Test, using the method described in Federal Specification TT-V-71, Paragraph F-2f.

e. When thoroughly mixed with Alcoa Albron Paste or Powder in the proportion of 2 pounds per gallon of vehicle, the paint shall have good leafing quality, show satisfactory brushing and leveling properties, and shall not break or sag when applied to a vertical, smooth, steel surface.

f. The *paint* shall set to touch in not more than 2 hours and dry hard and tough in not more than 18 hours at a temperature of 20° C. (68° F.) to 30° C. (86° F.).

16. Vehicle—Varnish Vehicle for Wood (Very Long Oil Varnish): The vehicle for use on weather-exposed wood shall consist of a very long oil varnish fulfilling the following requirements:

a. The varnish shall be clear and transparent.

b. The viscosity shall be between 0.50 and 0.85 poise at 25° C. (77° F.), corresponding to Tubes A to C of the Gardner-Holdt Air Bubble Viscometer, if it is to be used with Alcoa Albron Powder, or between 0.65 and 1.0 poise at 25° C. (77° F.), corresponding to Tubes B to D if it is to be used with Alcoa Albron Paste.

c. It shall contain not less than 50% by weight of nonvolatile oils and gums.

d. It shall pass a 100% Kauri Reduction Test, using the method described in Federal Specification TT-V-81, Paragraph F-2g.

e. When thoroughly mixed with Alcoa Albron Paste or Powder in the proportion of 2 pounds per gallon of vehicle, the paint shall have good leafing quality, show satisfactory brushing and leveling properties, and shall not break or sag when applied to a vertical, smooth, wood surface.

f. The *paint* shall set to touch in not less than 3 hours nor more than 8 hours and dry hard in not more than 24 hours at a temperature of 20° C. (68° F.) to 30° C. (86° F.).

17. For Wood Not Exposed to Weather: The vehicles for aluminum paint described in Paragraphs 12 and 15 may be used.

18. Vehicle—For High Temperature Work: Requirements for this type of vehicle shall be largely performance requirements, the composition being left entirely to the manufacturer, but fulfilling the following specification:

a. The vehicle shall contain not less than 20% nonvolatile matter.

b. The viscosity shall be not greater than 0.50 poise, cor-

responding to Tube A of the Gardner-Holdt Air Bubble Viscometer.

c. When thoroughly mixed with Alcoa Albron Paste or Powder in the proportion of 2½ pounds per gallon of vehicle, the paint shall have good color and show satisfactory adherence to a smooth 26 gauge black iron panel and shall not crack nor peel when the panel is bent over a ¼-inch rod through an angle of 180°, after 10 hours' heating of the panel at 500° C. (932° F.).

19-C. Vehicle—Nitrocellulose Lacquer: This specification is designed to cover a quick drying, durable lacquer vehicle for aluminum paste or powder for spray application as a product finish.

a. The vehicle shall be clear and transparent and shall not be darker than No. 6 on the Hellige Comparator.

b. It shall contain no toxic ingredients or injurious compounds.

c. Its viscosity at 25° C. (77° F.) shall be between 0.75 and 1.25 poise when diluted in the proportion of equal volumes of lacquer and the thinner recommended by the manufacturer.

d. The vehicle shall contain not less than 25% by weight of nonvolatile solids.

e. The vehicle shall air-dry to a high gloss in not more than 30 minutes.

f. A flow-out film on 28 gauge tin plate, after 24 hours' drying, shall show no whitening, dulling, nor visible attack when immersed in cold distilled water for a period of 15 hours.

g. The lacquer shall show complete freedom from "blushing." No streaks nor discoloration shall be apparent when two coats of the clear vehicle, suitably thinned, are sprayed on a metal panel at 90% humidity and 70° F.

h. The suitably diluted vehicle when incorporated with Standard Alcoa Albron Paste or Extra Fine Lining Alcoa

Albron Powder in the proportion of 1 pound of the paste or .5 pounds of the powder per gallon of the liquid shall produce a smooth free-flowing mixture of good working properties. The mixture shall not jell nor thicken appreciably on standing 96 hours in a three-quarters filled, tightly-closed container.

**19-D. Vehicle—Bituminous (Asphalt) Base Varnish:* This specification is designed to cover a durable, weather-resistant varnish containing asphalt as one of its principal ingredients and especially suitable as a vehicle for aluminum paint for the protection and insulation of composition or saturated felt or metal roofs and similar applications.

a. The vehicle shall consist of Gilsonite asphalt, vegetable drying oils, and a combination of V. M. & P. naphtha and coal tar solvent naphtha as the volatile proportion.

b. The net weight of 1 gallon of the vehicle shall be between 6.6 and 6.9 pounds, inclusive.

c. Its viscosity shall be between 1.2 and 1.4 times the viscosity of water as determined by an orifice viscosimeter.

d. It shall pass an 80% Kauri Reduction Test as described in Federal Specification TT-V-81, Paragraph F-2g, but shall fail to pass a Kauri Reduction Test in excess of 95%.

e. When thoroughly mixed with Alcoa Albron Paste or Powder in the proportion of 2 pounds per gallon of vehicle, the paint shall possess excellent leafing quality and when applied to a vertical sheet of composition roofing shall show satisfactory brushing and leveling properties and shall produce a brilliant, highly reflecting metallic film free from breaks, streaks, or sags.

f. Aluminum paint made with this vehicle, when applied to a metal panel and allowed to dry in a vertical position, shall set to touch in not more than 4 hours and dry hard and tough in not more than 24 hours, at a temperature of 20° C. (68° F.) to 30° C. (86° F.).

g. The paint film shall show only slight discoloration when

immersed in cold water for 15 hours and any discoloration shall have completely disappeared 24 hours after removing from the water.

19-E. Vehicle—Bituminous (Tar) Base Varnish: This specification is designed to cover a water-resistant and durable varnish containing coal tar and coal tar derivatives as the essential ingredients and is especially suitable as a vehicle for aluminum paint for painting concrete and metal structures where moisture conditions are unusually severe.

a. The vehicle shall be black in color and shall be derived from tar. It shall not contain either natural or petroleum asphalts.

b. It shall have a specific gravity of 1.04 to 1.07 at 25°/25° C. (77°/77° F.).

c. It shall have an Engler specific viscosity (50cc) at 40° C. (104° F.) of 2.0 to 5.0, inclusive.

d. It shall contain not more than 5% by weight of naphthalene.

e. It shall contain not more than 0.5% water.

f. When thoroughly mixed with Alcoa Albron Powder in the proportion of 2 pounds of powder per gallon of vehicle, the paint shall possess excellent leafing properties and when applied to a vertical, smooth, steel panel shall show good leveling and brushing properties and shall produce a brilliant metallic appearance free from breaks, streaks, or sags.

g. Aluminum paint made with this vehicle, when applied to a metal panel and allowed to dry in a vertical position, shall set to touch in not more than 8 hours and dry hard in not more than 24 hours at 20° C. (68° F.) to 30° C. (86° F.).

20. Specifications for Ready-Mixed Aluminum Paint:

a. Pigment: If a varnish grade of aluminum pigment (120 mesh to 160 mesh) is used, the paint shall contain not less

than 21% by weight of pigment; if a lining grade of aluminum pigment (200 mesh to 325 mesh) is used, the paint shall contain not less than 15% by weight of pigment.

b. Vehicle: The liquid portion of the paint, when extracted by means of a centrifuge, shall conform to the requirements of one of the preceding vehicle specifications (Paragraphs 12 to 19-E, inclusive); the specification to be met will depend upon the nature of the surface to be painted and exposure conditions.

c. General Requirements: The aluminum pigment shall not cake or harden in the package and shall be readily dispersed by moderate stirring for not more than 10 minutes, to form a paint with smooth, uniform characteristics and of good brushing or spraying consistency with complete absence of coarse particles or skins.

The paint shall not run, break, or sag when applied to a vertical, smooth, steel surface.

It shall possess good leafing qualities. The paint when flowed on a clean glass panel, supported at an angle of 45°, and then dried for 24 hours at 20° C. (68° F.) to 30° C. (86° F.), shall produce a film comparable in smoothness, color, luster, and opacity to that of a similar film applied at the same time and in the same manner, using a freshly-mixed aluminum paint made with the same type and amount of pigment and vehicle as that used in the ready-mixed paint.

Note: It is recommended that the ready-mixed aluminum paint be supplied in friction top tin cans up to 1 gallon capacity, or in 5 gallon full opening steel containers, or in 55 gallon steel drums with approved agitation device for stirring. A removable vent should be placed in the head of the two larger containers to permit the safe escape of any enclosed gas before the head is removed.

**Note:* Aluminum Company of America assumes no responsibility, under the above paint specification, arising out of claims of infringement of United States Letters Patent 1,568,215, dated January 5, 1926.

RECOMMENDATIONS FOR HANDLING AND STORING ALCOA ALBRON PASTE AND POWDER

FOR QUALITY

1. Keep both paste and powder in a warm dry room at a temperature between 60 and 80° F.

2. Keep containers at least one yard away from radiators or steam pipes.

3. Carefully cover, and reseal if possible, containers from which a portion of the paste or powder has been removed.

4. Keep absolutely dry.

GENERAL SUGGESTIONS

Note: These suggestions are intended to secure ideal storage conditions. The fire hazard involved in storing aluminum paste or powder in sealed containers is negligible. However, in the case of a fire involving the aluminum storage room, it is essential that the correct fire-fighting method be employed in that section of the building.

1. Store in rooms of fireproof construction if possible.

2. Do not store in same room with lacquers, varnishes, or other combustible material because of difference in fire-fighting methods.

3. Exercise good housekeeping. Rooms should be free of oily rags and other rubbish. Avoid accumulation of dust on walls, floors, or beams.

4. Keep dry. Leaks in steam lines, radiators, or roofs should be promptly repaired.

5. No smoking. Keep open lights and fire away.

6. Stack containers properly with ample aisle space. Keep containers closed when not removing contents.

7. Switches, fuse boxes, and motors should preferably be located outside the storage rooms. All other wires should be enclosed and lamps should be of vapor-proof type with wire guards. Use flashlights for emergency lighting.

8. Avoid friction of metal against metal or metal against concrete, such as that produced by careless handling of steel containers. Scoops should be made of aluminum or other nonsparking metal.

IN CASE OF FIRE

1. Never use water. It reacts with hot aluminum dust to form hydrogen and tends to spread the fire.

2. Have buckets of clean dry sand available. Sprinkle *gently* on the smoldering aluminum until it is completely covered and surrounded. *Caution:* Avoid the applying of sand in such a manner as to disturb the burning material. Do not use liquids of any kind. Do not use a gas which might disturb the powder.

3. Move all adjacent drums of paste and powder to a safe distance. Avoid disturbing the material actually burning, since floating dust in the vicinity of the fire might be ignited.

SUBJECT INDEX

W

Aluminum Company of America

SALES OFFICES

★

ALBANY, N. Y. . . . . 90 State Street
ATLANTA, GA. . . . . 1818 Rhodes-Haverty Building
BOSTON, MASS. . . . . 20 Providence Street, Park Square
BUFFALO, N. Y. . . . . 1880 Elmwood Avenue
CHARLOTTE, N. C. . . . . 619 Johnston Building
CHICAGO, ILL. . . . . 520 N. Michigan Boulevard
CINCINNATI, OHIO . . . . . 16th Floor, Times-Star Building
CLEVELAND, OHIO . . . . . 2210 Harvard Avenue
DALLAS, TEXAS . . . . . 1601 Allen Building
DENVER, COLO. . . . . 634 U. S. National Bank Building
DETROIT, MICH. . . . . 3311 Dunn Road
FAIRFIELD, CONN. . . . . Boston Post Road
HARTFORD, CONN. . . . . Capitol Building, 410 Asylum Street
INDIANAPOLIS, IND. . . . . 1008 Merchants Bank Building
KANSAS CITY, MO. . . . . 2306 Power & Light Building
LOS ANGELES, CALIF. . . . . 1031 S. Broadway
MILWAUKEE, WIS. . . . . 735 N. Water Street
MINNEAPOLIS, MINN. . . . 1345 Northwestern Bank Building
NEWARK, N. J. . . . . 1111 Academy Building
NEW ORLEANS, LA. . . . . 815 American Bank Building
NEW YORK, N. Y. . . . . 230 Park Avenue
PHILADELPHIA, PA. . 2307 Fidelity-Philadelphia Trust Bldg.
PITTSBURGH, PA. . . . . Gulf Building
ST. LOUIS, MO. . . . . 1002 Continental Building
SAN FRANCISCO, CALIF. . . . . 709 Rialto Building
SEATTLE, WASH. . . . . 1005 White Building
TOLEDO, OHIO . . . . . 915 Ohio Bank Building
WASHINGTON, D. C. . . . . 606 Southern Building

ALCOA ALUMINUM
ALBRON

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ALBRON

Form No. AD 123 8-37; 30-M

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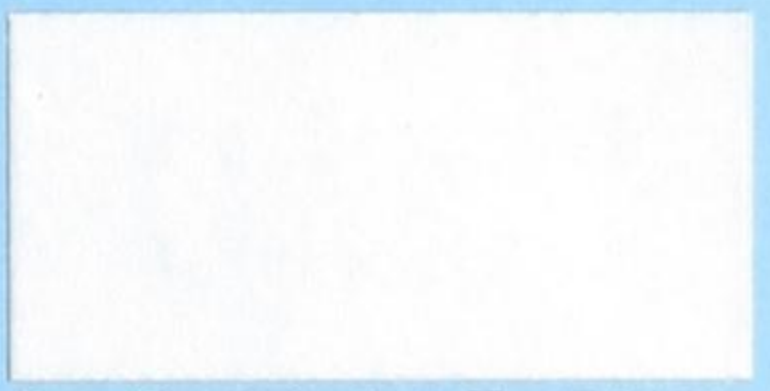
CHART

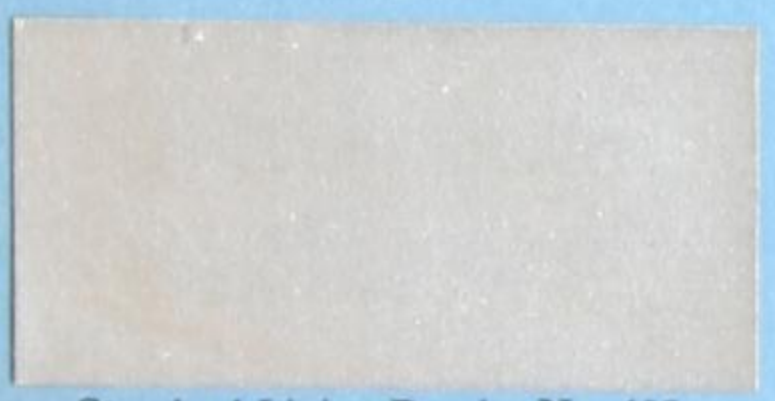
Showing Finishes Obtainable With

ALCOA ALBRON PIGMENTS

Standard Paste No. 205
In Varnish



Extra Fine Lining Paste No. 1570-1571
In Varnish



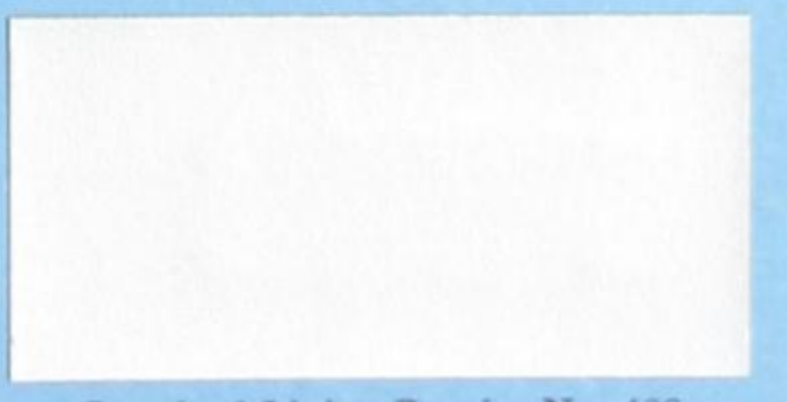
Standard Lining Powder No. 408
In Varnish

Extra Fine Lining Powder No. 422
In Varnish

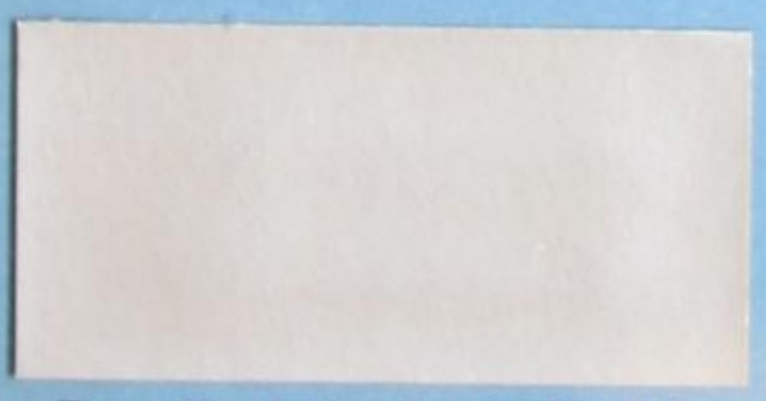
Standard Varnish Powder No. 321
In Varnish

Extra Brilliant Varnish Powder No. 301
In Varnish

Extra Fine Varnish Powder No. 341
In Varnish



Standard Lining Powder No. 408
In Lacquer



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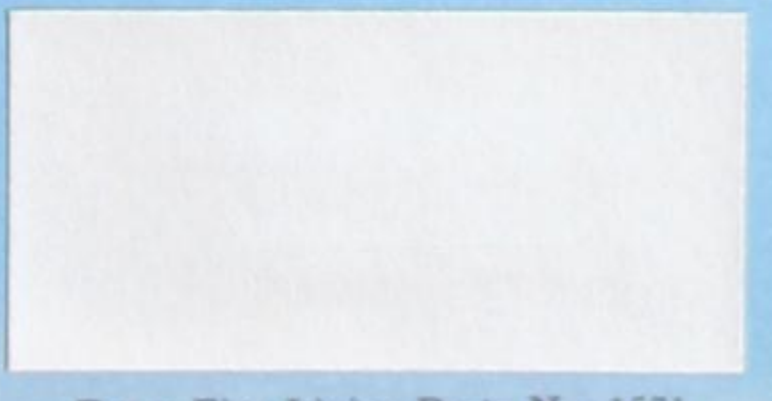
In Lacquer



Extra Fine Lining Paste No. 1571
In Lacquer